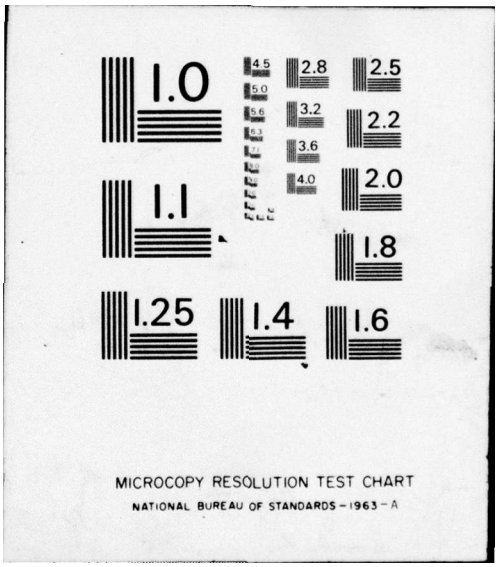
AD-A031 567 ARMY COMMAND AND GENERAL STAFF COLL FORT LEAVENWORTH KANS F/G 17/2
THE WIRED GARRISON DESIGN CONCEPT APPLIED TO FORT LEAVENWORTH, --ETC(U)
JUN 76 K D SAKAS

UNCLASSIFIED NL

1 OF 2
AD A031567


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
6.3
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS - 1963 - A

The Wired Garrison Design Concept Applied to Fort Leavenworth, Kansas

Karl D. Sakas, CPT, USA
U.S. Army Command and General Staff College
Fort Leavenworth, Kansas 66027

Final report 11 June 1976

Approved for public release; distribution unlimited.

A Master of Military Art and Science thesis presented to the faculty of the U.S. Army Command and General Staff College, Fort Leavenworth, Kansas 66027

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER (6)	2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER (9)	
4. TITLE *(and Subtitle)*: The Wired Garrison Design Concept Applied to Fort Leavenworth, Kansas	5. TYPE OF REPORT & PERIOD COVERED: Final Report, 11 June 76
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s): Sakas, Karl D., CPT, USA (10)	8. CONTRACT OR GRANT NUMBER(s): Karl D. Donust/Sakas
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Student at the U.S. Army Command and General Staff College, Fort Leavenworth, Kansas 66027	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS: US Army Command and General Staff College ATTN: ATSW-SE (11)	12. REPORT DATE: 11 Jun 76 (12)
	13. NUMBER OF PAGES: 112 (119 p.)
14. MONITORING AGENCY NAME & ADDRESS *(if different from Controlling Office)*	15. SECURITY CLASS. *(of this report)*: Unclassified
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

Master of Military Art and Science (MMAS) Thesis prepared at CGSC in partial fulfillment of the Masters Program requirements, U.S. Army Command and General Staff College, Fort Leavenworth, Kansas 66027

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

See reverse.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

4/B

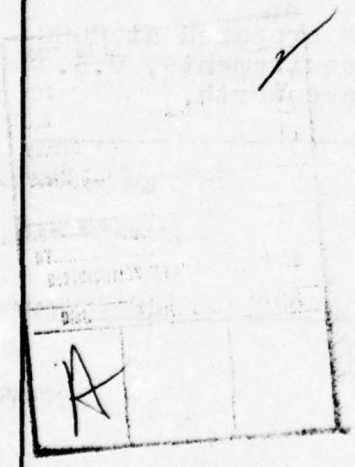
037260

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

The Wired Garrison Communications-Electronics Design Concept incorporates technological advances to best serve Army installation communication needs. The Fort Leavenworth user needs have increased during the past few years. The Army has not applied the Wired Garrison Concept to Fort Leavenworth.

This study seeks to determine if the Army could apply the Wired Garrison Concept to Fort Leavenworth to meet the short-term projected communications requirements.

Investigation reveals that the Wired Garrison Communications-Electronics Design Concept can be applied to Fort Leavenworth, Kansas. The Wired Garrison is suitable to support the United States Army Combined Arms Combat Developments Activity. This concept is particularly applicable to the needs of the United States Army Command and General Staff College.



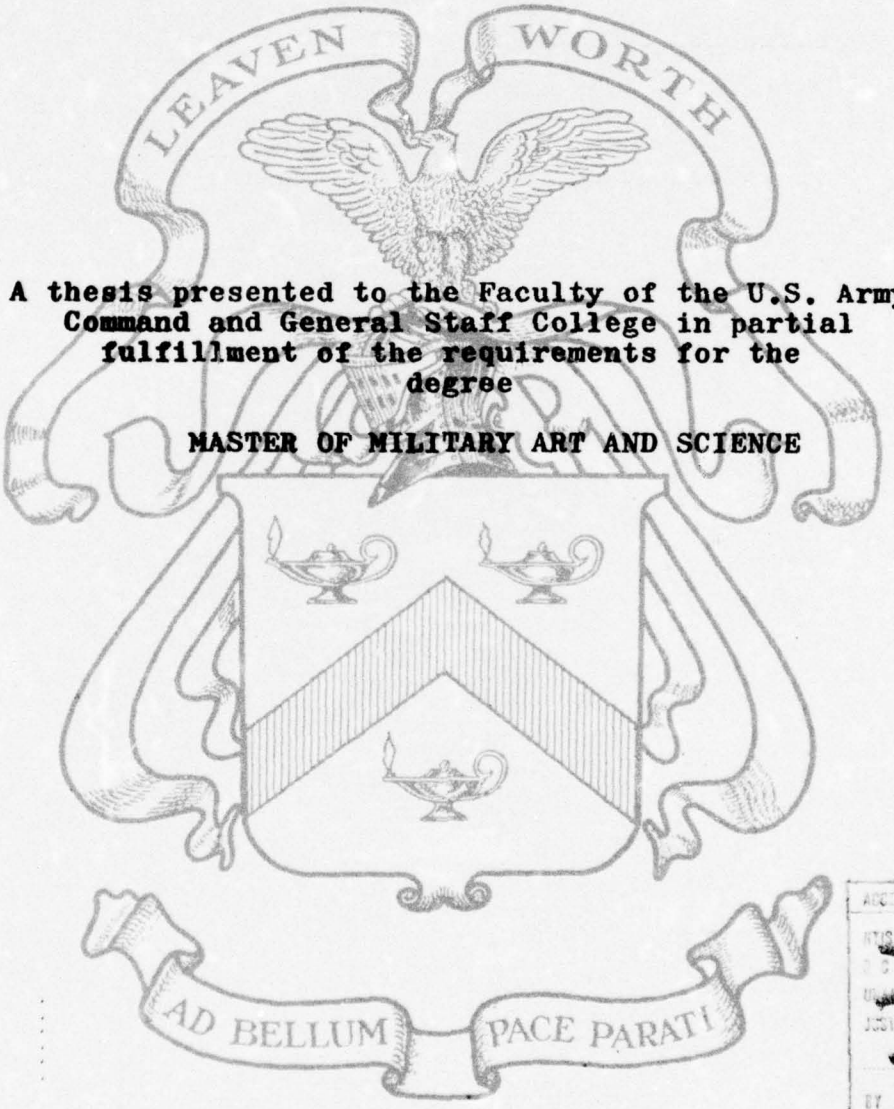
THE WIRED GARRISON DESIGN CONCEPT

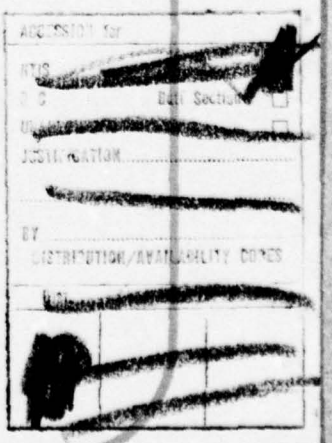
APPLIED TO

FORT LEAVENWORTH, KANSAS

A thesis presented to the Faculty of the U.S. Army Command and General Staff College in partial fulfillment of the requirements for the degree

MASTER OF MILITARY ART AND SCIENCE





Fort Leavenworth, Kansas
1976

5L5-3150

THE WIRED GARRISON DESIGN CONCEPT

APPLIED TO

FORT LEAVENWORTH, KANSAS

A thesis presented to the Faculty of the U.S. Army Command and General Staff College in partial fulfillment of the requirements for the degree

MASTER OF MILITARY ART AND SCIENCE

by

K. D. SAKAS, CPT, USA

B.S., United States Military Academy, 1967
M.A., Middlebury College/University of Mainz, 1972
M.B.A., Long Island University, 1974
M.S., Long Island University, 1975

Fort Leavenworth, Kansas
1976

MASTER OF MILITARY ART AND SCIENCE

THESIS APPROVAL PAGE

Name of candidate Karl Donus SAKAS

Title of thesis The Wired Garrison Design Concept

Approved by:

[signature], Research Advisor

[signature], Member, Graduate Research Faculty

[signature], Member, Consulting Faculty

Accepted this 10th day of May 1976 by

[signature], Director, Master of Military Art and Science.

The opinions and conclusions expressed herein are those of the individual student author and do not necessarily represent the views of either the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

MMAS - The Wired Garrison Design Concept Applied to Fort Leavenworth, Kansas

ABSTRACT

The Wired Garrison Communications-Electronics Design Concept incorporates technological advances to best serve Army installation communication needs. The Fort Leavenworth user needs have increased during the past few years. The Army has not applied the Wired Garrison Concept to Fort Leavenworth.

This study seeks to determine if the Army could apply the Wired Garrison Concept to Fort Leavenworth to meet the short-term projected communications requirements.

Investigation reveals that the Wired Garrison Communications-Electronics Design Concept can be applied to Fort Leavenworth, Kansas. The Wired Garrison is suitable to support the United States Army Combined Arms Combat Developments Activity. This concept is particularly applicable to the needs of the United States Army Command and General Staff College.

Captain Karl D. SAKAS
Section 11, USACGSC

TABLE OF CONTENTS

Chapter 1.

Introduction

Chapter 1. deals with the thesis problem statement, the objectives of the paper, the scope of the research effort and the internal organization of the paper itself. In addition this chapter reviews the literature, discusses the materials and methods of research and briefly introduces the background of the problem. Chapter 2. treats this background discussion in greater detail.

a. Thesis Problem Statement

"The Wired Garrison Communications-Electronics Design Concept incorporates technological advances to best serve Army installation communication needs. The Fort Leavenworth user needs have increased during the past few years. The Army has not applied the Wired Garrison Concept to Fort Leavenworth. The problem is whether the Army could apply the Wired Garrison Concept to Fort Leavenworth to meet the short-term projected communications requirements?"

b. Definition of Terms

The Wired Garrison Communications-Electronics Design Concept was formulated by the Mitre Corp. for the Commanding General, United States Army Strategic Communications Command (now the United States Army Communications Command[1]), 30 June 1973. This concept incorporates the system, equipment and services required to meet the current and projected communications needs of the Army garrison.[2]

c. Objectives

The objectives of this paper are threefold. First it explores the general aspects of the Wired Garrison Communications-Electronics Design Concept as originally formulated. Second it investigates those recent innovations in equipment and design which affect the original concept. Third it applies the concept to the Fort Leavenworth installation. In this regard it focuses on short-term projected communications requirements. Short-term refers to a two year period.[3]

d. Scope

The scope of the research effort incorporates the original documents from the Mitre study, input from professional journals treating innovations in the field, interviews with key managers at Fort Leavenworth, Kansas, as well as current projections of communications requirements from the United States Communications Command Detachment at Fort Leavenworth.

e. Organization

The Thesis Outline reflects the internal organization of the thesis in a numbered-chapter format. Chapter 1. discusses the problem statement, definitions, thesis objectives, the scope of the research effort, internal organization, a review of the literature, the materials and methods of research as well as a brief introduction to the background of the thesis problem.

Chapter 2. deals with the Wired Garrison Communications-Electronics Design Concept as formulated by the Mitre Corp. This chapter lays the foundation for the study by conducting an in-depth analysis of the environmental dynamics which precipitated the Wired Garrison effort. The chapter investigates the various aspects of the Wired Garrison, defines those components of the Communications-Electronics Design and treats those innovations in technology and systems which led to the 1973 period conception of Wired Garrison applications.

Chapter 3. focuses on the environment of the Army Garrison of today and of the future. This chapter identifies the general areas of user needs and addresses specific critical requirements for communications-electronics support of the Army mission and of those people accomplishing that mission.

Chapter 4. discusses briefly the idea of a testbed approach to the application of the Wired Garrison Concept. A testbed is an actual, representative Army installation at which a type of Wired Garrison Design can be built, operated and evaluated. This chapter discusses briefly such a testbed application at Fort Bliss, Texas.

Chapter 5. investigates the short-term communications requirements of Fort Leavenworth, Kansas. The chapter discusses how the Wired Garrison Design Concept may be applied in its entirety or in part to Fort Leavenworth. In this regard a type Wired Garrison testbed is considered.

At the conclusion of each chapter, on a separate page, there is a list of endnotes referring to those sources supporting the direct and paraphrased entries in the corresponding chapter.

The Bibliography includes an annotated list of all sources which provided input to the research effort. The bibliography is divided into five sections - primary wired garrison studies, documents related to the wired garrison studies, articles reflecting technological innovation, articles by military communicators and interviews. A general review of the literature is included as part of Chapter 1., Introduction.

f. Review of the Literature

The annotated bibliography gives data on the individual pieces of source material. These sources are grouped into the five categories previously-mentioned.

The primary wired garrison studies form the basis for research. These Mitre Corp. documents report on the Wired Garrison Design Concept as it was formulated originally.

Those documents related to the wired garrison studies provide excellent background on Department of Defense contributions to the general area of communications.

Articles reflecting technological innovation draw upon the research and development, commercial and industrial sectors for an insight into some technological alternatives to the existing system.

Articles by military communicators and others contribute invaluable perspective to projected user needs and the technological applications which can meet those needs.

Finally the interviews provide first person information on selected areas.

g. Materials and Methods of Research

The most appropriate method of research for this thesis problem is a combination of the historical and descriptive methods. The materials lend themselves to this approach. The results of previous studies warrant further analysis. Furthermore, contemporary materials must be scrutinized to determine their degree of applicability to the thesis problem. In this particular research effort a continuing review of all materials is necessary. The whole research process must be reevaluated at each stage of the endeavor to insure that the procedure is best suited to the thesis problem. The impact of new technology coupled with the changing user needs of the Fort Leavenworth Army Garrison have made it necessary for the research effort to remain flexible enough to receive and process new input while moving toward an appropriate solution to the thesis problem.

h. Background to the Problem

Chapter 2. is devoted to a detailed analysis of the integrated communications-electronics (C-E) system.

On many Army installations the communications support depends on equipment and systems rendered obsolete by advances in technology. As found in the Mitre studies, the plant of the 1970's frequently is based upon World War II technology and requirements. A forward-looking approach is needed to deal with the requirements of the present and the future. The Wired Garrison Communications-Electronics Design Concept offers one such alternative approach.[4] Specifically, is such a design concept applicable to the current and projected communications needs of Fort Leavenworth, Kansas?

ENDNOTES (Chapter 1.)

[1]Major General Jack A. Albright, "Communications Command: First There Was a Lantern," Army, October 1975, 87.

[2]J.G. Wohl and others, Integrated Communications-Electronics Systems and Facilities for Army Garrisons (Bedford, Mass.: The Mitre Corp., 1973) p. iii.

[3]An interview with Mr. Sid L. Bonnel, Director, Communications-Electronics, Fort Leavenworth, Kansas, 66027, conducted on 7 November 1975.

[4]Wired Garrison Project Team (Sponsor - United States Army Communications Command), System Definition for Army Wired Garrison C-E Design, Vol. I, "Executive Summary," 1974, p. i.

Chapter 2.

The Wired Garrison Concept

Chapter 2. discusses the Wired Garrison Communications-Electronics (C-E) Design Concept as formulated by the Mitre Corp. This chapter develops the thesis by conducting an in-depth examination of the environmental dynamics which precipitated this study. The various aspects of the concept of a wired garrison are investigated. This portion of the paper defines those components of the Communications-Electronics Design crucial to its comprehension and appreciation. The chapter treats those innovations in technology and systems engineering which led to the 1973 study of Wired Garrison applications. Also Chapter 2. introduces the investigation of new equipment and systems which affect the Wired Garrison Design as it was conceived originally.

Historically military users have always demanded the most current communications services to meet their needs. When the science and industry team makes advances in technology, military users require the very latest in equipment and systems.[5] The CONUS (Continental United States) Army post, camp and station situation is no exception. The Mitre Corp., working for the United States Army Strategic Communications Command (Contract Sponsor), observed that there existed an ever-widening gap between Army installation planning and communications-electronics potential.[6]

Not only has technology advanced far beyond the scope of much installation planning, but current and projected user needs have exceeded much of the capacity which has been programmed for future expansion. For example, the DCS (Defense Communications System) originally planned for 10 percent annual growth in demand for digital communications. This estimate was based on the needs of the individual services (Army, Navy, Air Force). Recent surveys reveal that a rate of growth for digital services will be closer to 25 percent per year.

At this higher rate of increase, digital traffic in ten years will be 1000 percent that of today.[7] Of course the Army communications role in support of the Defense Communications System is a major one.[8] Interestingly enough the digital traffic extends beyond the obvious AUTODIN application. The digital service reflects secure voice traffic, special secure data, digital video advances and the breakthroughs in services to include such approaches as inter-computer communications.[9]

Digital communication is but a portion of the new audio, video and data technology in operation and under development.[10] Both business and government have been investigating the possibilities of typewriter-to-typewriter communication. In such an operation the word-processing function is elevated to higher levels of potential service to the user. Both the Navy Recruiting Command and the Library of Congress are dealing with these communicating, editing and recording systems.[11] Recent studies indicate that more than 90 percent of

the time required for a message to travel from the sender to the receiver is used for message preparation and handling before it actually reaches the telecommunications center.[12]

Along with these aspects of record communications, such areas as fiber optics, signal security, switching, video transmissions and new applications of cable are important fields of communications-electronics. The Army Communications Command (ACC) (formerly the USASTRATCOM as cited in endnote 1.) is responsible for an on-going study of these communications implications of technological advance. The Army Base Information Transfer System - ARBITS is the title of this study which is the continuation of the Wired Garrison.[13] For purposes of this thesis the original Wired Garrison Design Concept as formulated by the Mitre Corp. will be used as the basis for research. Innovations in the state-of-the-art will be treated as building blocks set upon the foundation of the Wired Garrison Design Concept.

The Wired Garrison Design Concept for Army posts

incorporates an integration of communications-electronics facilities utilizing system engineering for a multimode (as described below) approach. At this point it is necessary to understand the definitions of certain terms inherent to the comprehension of the Wired Garrison Design Concept. The Mitre study forms the framework for these interpretations of meanings.

The Mitre study begins with a consideration of modes of distribution. These modes of distribution or distribution modes as applied to the information flowing in a system can be categorized into three broad areas. One-point transmission to more than one receiver is designated a broadcast mode. Conversely, more than one point transmitting to one receiver on command is the gathered mode. The third mode is the simple point-to-point which is self-explanatory.[14]

When two or more modes of distribution are utilized in a network, the system is designated a multimode delivery system. Interconnection applies to the interface of various elements within a system

established to insure information flow without breaks. Specifically, this can apply to the interface of public and private telephone systems.[15]

An Integrated Garrison Communications-Electronics (C-E) System is defined by the Mitre study as

> A system-engineered, two-way, interconnected, hybrid network of coaxial cable, wire-pair, mobile radio, and microwave links for multimode delivery of garrison communications services.[16]

On the Army installation all physical plant and supporting systems required for communications-electronics support of the primary mission (defense readiness) as well as general support of post operations are considered part of the overall garrison C-E responsibility.[17] The Wired Garrison itself includes all of the above-defined characteristics. It is an integrated garrison C-E system incorporating both current and projected user requirements for an Army installation. The system is multimode and addresses those communications-electronics services necessary for mission support and post operations.[18] The Army has been conducting certain communications-electronics programs and projects which affect both

directly and indirectly the Wired Garrison Communications-Electronics Design Concept. The whole field of endeavor has been and continues to be so dynamic that planning and the incorporation of the new technology into current systems is a way of life.[19]

These Army programs and the forces which are driving them warrant attention. Digital communications play a major role in almost all aspects of defense communications today. The secure mode of operation is closely related to the advances in digital communications. The Army is appreciating the integration of satellite communications with digital capabilities for improved command and control telecommunications. These innovations affect the coordination of the combat power of the Air Force and Navy with that of the Army. The Army Communications Command (ACC) plays a major role in the Army portion of this communication responsibility.[20]

The great increase in projected digital traffic, as cited on pages 12 and 13 of this thesis, emphasizes the critical role this increase in volume plays in installation C-E planning. Approaching

this area from the Defense Communications System (DCS) standpoint, four considerations are apparent. Design guides should be established to provide a basis for some sort of standardization and to remove any obstacles to system interface. Final planning for National Command and common user requirements should be consolidated at the Department of Defense level. Technology should continue to provide the hardware needed to meet projected digital needs. Finally, future digital requirements should be predicted accurately.[21] At this point in the development of digital systems, the Department of Defense has decided to move from analog-FDM (frequency division multiplexing) to digital. This is of particular importance in those areas of secure voice digital mode communications.[22]

In this atmosphere of change in technology and increase in user requirements, the Army garrison communications-electronics support of the primary mission and Army community life becomes more complex. In most Army installations the communications-electronics plant is based on multi-conductor cable, which has been overlaid with non-standardized conductors and incompatible equipment. Additionally the garrison media include radio nets and both cable and closed-circuit television systems.[23]

The Army garrison system lends itself to an integration of components and an assimilation of new technology. As previously mentioned, the user needs for data communications, record communications and message communications, to say nothing of the emerging need for digital services, will affect maintenance costs of existing operations. Not only are these maintenance costs of the current plant prohibitive, but the present equipment is not compatible with that being produced and assimilated into the system.[24]

What is needed is a means by which the communicator can integrate those technological innovations which satisfy current and projected user requirements. Of course such a means should be feasible over the long-term of installation and operation. That is, it should be less expensive to introduce the new technology than to retain the current practice of adding systems in a piecemeal manner without achieving an integrated design. The coaxial cable presents the most logical means to achieve this end.[25]

The coaxial cable is the basis for the wired garrison design concept. It incorporates characteristics which make it compatible with existing equipment as well as with new technology being introduced to communications-electronics systems. Furthermore, coaxial cable is well-suited to support the necessary transition from the present nonintegrated operation to the projected integrated communications-electronics design as visualized within the parameters of the wired garrison concept.[26]

Both coaxial cable and the computer are vital to the new C-E technology. The cable is the wiring/transmission basis for the application of the wired garrison concept. The computer is the technological center of the closely-related area of information processing. Any appreciation of the wired garrison should include an understanding of the strong interrelationship that exists between telecommunications and information handling.[27] On one hand, communications managers have automated the management information systems which support their decisionmaking process.

However, these same communicators have seen the necessity to automate telecommunications to serve user needs. And among these user needs is the transmission of management information to be processed by these same managers.[28] Telecommunications and data processing have converged to such an extent of interdependence that it is difficult to establish exactly where one area ends and the other area begins.[29]

If the growth and refinement of this critical relationship is managed effectively, the Army garrison can profit in three significant respects. The wired garrison supports the primary Army mission, Army installation operations and the people living in the Army community. The improved flow of vital information within the chain-of-command and the increased efficiency of military and civilian training through improved communications will upgrade unit combat readiness to perform the primary Army mission of national defense. The improved communications-electronics and information processing will combine to

streamline post operations -- logistics, personnel administration, contracting and procurement . Finally, the centralized,standardized and systematized garrison communications-electronics base will increase the breadth and depth of services available to the individual soldier and his family.[30]

The Army Telecommunications Automation Program (ATCAP), under the management responsibility of the Army Communications Command (ACC), is focused on this very problem of applying the technology to the three above-mentioned areas in a manner and at a cost which is feasible.[31] Inherent in ATCAP is a cutback in those personnel required to operate the communications-electronics system and a corresponding improvement in the speed and quality of traffic flow.[32]

In moving from the existing installation communications-electronics plant to the wired garrison design,it would be foolish, wasteful and impractical to eliminate completely the

existing system and then commence to install the new equipment. Not only are components of the current plant useable in the wired garrison, but the coaxial cable attribute of the wired garrison design will enable the communicator to make the necessary transition without a degradation of the C-E services. Actually there is more than one way to approach this transition. The question is, which method is best?[33] Each Army installation may require a different modification of a fundamental transition plan. As mentioned earlier in this paper, the goal of the transition will be an integrated communications-electronics configuration.[34]

The Mitre Corp. recognized four phases for the implementation of the wired garrison design concept on Army installations. These are "specification and coordination, validation, prototype and finally production and deployment."[35] In the succeeding chapters this program will be dealt with in greater detail. Chapter 3. will examine the environment of the Army installation

and will focus on user needs. Chapter 4. then will consider the idea of a testbed for experimentation with the wired garrison system in a real situation. In this way one may examine the strengths and weaknesses of the application of the concept. Furthermore, one may modify the design wherever necessary to tailor technology to meet user needs.[36]

ENDNOTES (Chapter 2.)

(Sources repeated from the preceding chapter's ENDNOTES are given in full for easier reference by the reader.)

[5]Major General Jack A. Albright, "Communications Command: First There Was a Lantern," Army, October 1975, 93.

[6]J.G. Wohl and others, Integrated Communications-Electronics Systems and Facilities for Army Garrisons (Bedford, Mass.: The Mitre Corp., 1973) pp. i-iii.

[7]R.P. Witt and others, Air Force Planning for Digital Communications (Bedford, Mass.: The Mitre Corp., 1970) p. 5.

[8]Joint Chiefs of Staff, JCS Pub. 2. Unified Action Armed Forces (UNAAF), Washington, D. C., 1959, p. 75c.

[9]Witt, op. cit., pp. 5-6.

[10]Wohl, op. cit., p. iii.

[11]Executive Briefing, "The Office of the Future," Business Week, June 30, 1975, p. 51.

[12]Albright, op. cit., p. 91.

[13]Major General Jack A. Albright, "R & D Requirements and Perspectives," Signal, October 1975, p. 66.

[14]Wohl, op. cit., p. xiii.

[15]Ibid.

ENDNOTES (Chapter 2., continued)

[16]Ibid.

[17]Ibid.

[18]Ibid., p. xiv.

[19]Albright, "Communications Command," pp. 88-93.

[20]Albright, "R & D Requirements and Perspectives," p. 66.

[21]Witt, op. cit., pp. iii-2.

[22]R.P. Witt and others, An Economic Comparison of Analog vs Digital-Based Common User Communications, Bedford, Mass.: The Mitre Corp., 1970, p. iii.

[23]Wohl, op. cit., p. 1.

[24]Ibid.

[25]Ibid.

[26]Ibid., pp. 1-11.

[27]Brigadier General Gerd S. Grombacher, "The Army's View of Trends in Military Switching Systems," Signal, August 1975, pp. 79-81.

[28]Albright, "Communications Command," p. 93.

ENDNOTES (Chapter 2., continued)

[29]An interview with CW4 B. C. Hedge, Plans/ Operations Officer, United States Army Communications Command Detachment, Fort Leavenworth, Kansas, 66027, September 1975.

[30]Wohl, op. cit., pp. 5-7.

[31]Grombacher, op. cit., pp. 80-81.

[32]Albright, "Communications Command," pp. 91-93.

[33]Wohl, op. cit., 7-11.

[34]Ibid., p. iv.

[35]Ibid., pp. 8-10.

[36]Ibid., pp. 10-11.

Chapter 3.

The Army Garrison Environment

Chapter 3. focuses on the environment of the Army garrison of today and of the future. This chapter identifies the general areas of user needs and addresses specific critical requirements for communications-electronics support of the Army mission and of those people accomplishing that mission.

As the technological environment of communications-electronics has changed over the years, so has the Army Garrison Environment developed into something quite different from that of even the recent past. Although this chapter will concentrate on the area of user needs, it will continue to introduce discussion of technological innovation as this innovation applies to specific portions of user need. This continuing focus on technology follows the precedent established in Chapters 1. and 2. As cited earlier, Army garrison communications-electronics (C-E) needs can be categorized into three general areas. These are the C-E support of the primary Army mission of national defense, the C-E support of installation operations and the C-E support of the military and civilian persons living on or near the Army garrison.[37]

Some of the changes in user needs are a reflection of the evolution of the American society of which the Army installation is a part. Furthermore, the very technology which is being adapted to satisfy changing user needs forms an important part

of the environment in which the user lives. Technology plays the dual role of being a major force in the user environment and of serving as an instrument designed to assist the user to modify this environment or to adapt to it.[38]

Past technological advances such as the automobile, television and nuclear reactors have opened new horizons for sociological change in the civilian world and on the Army installation. An atmosphere is created in which new alternative solutions to existing problems become available. The question then becomes - not is there a solution, but rather which solution of those available is most appropriate?[39]

Communication in both the interpersonal sense and the technological sense affects and is, in turn, affected by change. Communications means serve to channel information about the accelerated rate of change to the people. These same means provide feedback from the people to the persons or institutions held responsible for this change.

Although funding and legal regulation are restricting the application of C-E technology to serve user needs, the same parties instituting the restrictive measures are demanding C-E support which utilizes all the technology available and which suffers no degradation of quality.[40] These users are demanding C-E support for such diverse areas as biology, computerization, ecology, transportation and national defense.[41] The Army installation with its hospital, data processing center, environmental systems, transportation organizations and military units has representatives of these user types.

The entire area of national defense and the related area of command control communications are undergoing a continuing process of reevaluation. The social and economic implications of national defense have a position of relative importance equal to that of the obvious military and political/ diplomatic aspects of waging war. There is an appreciation for the limitations which exist in the

area of resources available for defense or social welfare but not for both portions of Federal budget expenditure. The direct result in the Army community is the relative decrease in funds and manpower provided to accomplish the primary mission of national defense, to support installation operations and to care for the people in the Army community.[42]

Within the context of the current technological-sociological environment in the world and United States as just depicted, this chapter now moves to a consideration of the Army garrison environment in particular. For the purposes of this report, environment of an Army installation consists of

technological (existing communications-electronics plant) and sociological/operational (mission support, post support and people support requirements) components. Army installations located in the continental United States (CONUS) may be classified into five categories based upon primary mission. Major Headquarter Posts are represented by such installations as Fort Meade and Fort Monroe. Fort Benning and Fort Knox are considered Large Training Posts with School. However, Small School and Center Posts include such locations as Fort Gordon, Fort McClellan and Fort Eustis. Fort Carson, Fort Dix and Fort Hood are classified as Large Troop and Training Posts. Finally, Fort Huachuca and such Army Material Command Posts as Fort Monmouth and Redstone Arsenal are considered Class II Installations.[43]

On each of these installations communications-electronics services fall into three broad categories mentioned previously. Under the heading of support of the primary Army mission, C-E services focus on command and control functions

of the senior command group and the entire chain-of-command. Mission support also involves the vital C-E services required for the Army schools and Army training programs. Support of installation operations includes the fundamental clerical functions performed in offices and the transfer of information. This latter area of installation support includes such things as telephone, daily bulletin, telephone listings, mail, record traffic, message center, facsimile, rosters of various types and other information categories which may or may not currently be supported by communications-electronics service. Where communications-electronics support does exist it is conceivable that it could be expended. Where it does not exist it could be introduced. Finally, support of the people in the Army community includes those communications-electronics services associated with the basic functions performed by any civilian community and its local government for the citizens. These are represented by medical, dental and life support activities, police and

fire-fighting units, education for the youth and adults, recreation facilities and the opportunity for entertainment.[44]

This chapter now addresses the general types of C-E facilities presently operating on the installations located within the CONUS. Although the actual C-E plant varies at Army installations, certain components are generally prevalent. This chapter discusses the general cases. Chapter 4. covers the testbed approach to such general C-E system components. That chapter also addresses Fort Bliss, Texas, as the testbed selected by the Mitre Corp. Chapter 5. focuses on the Fort Leavenworth C-E plant.[45]

C-E facilities presently found on Army posts can be classified into general areas. The post telephone plant and radio nets serve point-to-point user needs. CATV (Community Antenna Television distribution systems), CCTV (closed-circuit television systems), special purpose radio nets as well as data services via AUTODIN all contribute to the C-E capability. Along with the above-mentioned systems, many Army schools possess independently operating audio-visual facilities.

Of course the post telephone plant is the high-volume backbone of the C-E plant. And although local message circuits and AUTODIN data services may use a portion of the telephone facility, these services are isolated from actual telephone plant control. For the purposes of this report audio public address systems and audio recording equipment for stenographic services will not be included.

The arrangements for ownership of the post telephone plant vary among CONUS Army installations. The systems are either leased from a commercial firm or owned and operated by the Army. The service provided by these telephone systems is considered in four classes. Class A telephones are for official use on the post and for access to commercial facilities for authorized transactions. Class B service is unofficial service for calls within the Army system through military switchboards. Class C telephones provide official-restricted service, that is, without access to commercial facilities. Class D service is defined as official-

special for classes of service to include alarms (guard, fire, crash).[46]

The coaxial cable which is essential to the implementation of the Wired Garrison C-E Design Concept is the same transmission means used in the CCTV and CATV systems.[47] As with the post telephone plant, some of these cable systems are Army-owned and operated while others are leased from commercial firms. In this regard Army Regulation AR 108-40, effective 15 January 1973, outlines the procedures for the Army lease of commercial CATV/MATV (Master Television Antenna) services. The regulation appreciates the potential for the application of coaxial cable as in the Wired Garrison to meet user needs.[48]

The selection of the appropriate approach to the analysis of Army installation user needs is critical to the success of the Wired Garrison Concept.

This selection should be based upon three objectives. Among the available options only those systems and components which meet identifiable Army garrison needs should be incorporated in the Wired Garrison application. That is, needs should dictate the appropriate technology and not vice versa. Too often in the past the researchers and developers did produce some innovation only to have the users then search for a need or requirement which this new technology could satisfy.

The second objective is to organize these applicable C-E systems and equipment with respect to space and time to insure a smooth transition from the existing plant to the wired garrison design. This system implementation must be conducted without degradation of C-E support. Furthermore, the application of the new technology must not disrupt the normal Army installation functions of primary Army mission, post operations and Army community support.

The final objective is to design the user needs analysis so that the results of this analysis lend

themselves to interpretation into an operational system. The more logical the organization of the needs analysis, the easier it will be to design a system to best serve those needs.[49]

For the purposes of the Mitre study, Army needs were examined in four broad areas. These areas were applicable throughout the Army. They could be related to the previously-mentioned functions performed on each individual Army installation (mission, post operations, people support). The first general area of Army need surrounds the All Volunteer Army concept and all the implications of its implementation. The second area relates directly to the All Volunteer effort. This is the endeavor to retain the maximum number of quality soldiers in the volunteer force through reenlistment. Third is the area of education/training which is essential to providing a high quality volunteer force and to providing an incentive to the volunteers to continue to serve. Finally, the Army has, as always, the requirement for the most efficient system of administrative support for the combat element.

The possible applications of this technology to Army needs (all volunteer force, retention of volunteers, education/training of soldiers and efficient administration) and to the three specific areas of Army garrison support (primary mission, post operations and people support) are numerous and varied. Each Army installation in CONUS presents its own set of conditions, needs and existing plant. Some applications are computer assisted instruction (CAI with all its variations), editing of texts (altering textual material contained in computer memory), electronic mail and teleconferencing for the commander and his staff or subordinates.[50]

Of particular importance on the Army installation and in the entire Army structure is administrative information transfer. This is a fundamental Army need which yields itself to numerous C-E support applications, as investigated by the Mitre Corp.[51] For the purposes of this paper, this area of <u>administration</u> will receive special attention. This attention will concentrate on administration-related communications-

electronics needs and how available technology can be applied to best serve these needs. Although no one need can be considered typical of those needs across the continuum of Army garrison requirements, the area of administrative information transfer is indicative of the scope and depth of the need analysis surrounding each C-E requirement.

This area of administrative applications for C-E technology is important in both the civilian and military sectors. Chapter 2. discussed the civilian implementation of digitalization and word-processing systems. In any organization the administrative functions are operative at all levels of activity, and the Army is no exception in this regard. Improved C-E support provides the opportunity to make these administrative processes more efficient. This study can identify seven general areas of administrative information transfer which warrant improvement. They are paperwork accumulation, processing time, manpower costs, data requirements, information access,

error rate and worker satisfaction.[52]

These seven aspects of administration are consistent with on-going Army management studies directed at streamlining and making more effective the Army's administrative procedures. The first of these seven aspects is the reduction of paperwork accumulation and the accompanying proliferation of forms and file copies. The next aspect is the prohibitive length of time associated with information processing prior to and during the actual transmission from sender to addressee. Chapter 2. mentioned Major General Albright's comments on this particular area. The third area of concern is the high cost of manpower required to process the overwhelming administrative workload. Automation and C-E technology can yield some solutions to this expensive problem of prohibitive manpower levels.

The next four fields of user need relate to information flow and the human element of administering complex systems. The fourth of the seven fields is the complexity of the data requirements placed on the units in the Army by the senior managers.

These managers need detailed, accurate and regular reports of operations to assist them in the decision-making process. The next area of concern is related closely to the fourth (improved reporting). This is the problem of timely and complete information access. The sixth problem exists throughout the entire administrative information transfer system. A reduction in the error rate is important to the success of any innovation in this whole area of administration. Finally, as the technology is applied to these areas of administration, the human factor must be considered. Regardless of the level of technological sophistication the system possesses, the people should feel that their role is challenging and significant.[53]

Those existing C-E programs which may affect the Wired Garrison require mention. Certain aspects of the Wired Garrison are contained in these programs and studies. Also, the Wired Garrison study has drawn on other Army C-E projects for input. On-going programs include ATCAP (Army Telecommunications

Automation Program) and AMME (Automated Multi-Media Exchange) program, which is part of the ATCAP. A recently initiated program is the LDDS (Local Digital Distribution System).[54] Of course there is ARBITS (Army Base Information Transfer System) as mentioned in Chapter 2. of this paper.[55]

These programs warrant a concise explanation of their objectives. ATCAP is designed to consolidate/automate,on an area basis, Army communications centers and message centers. Technically it is oriented on multi-media automation and standardization of configurations of hardware/software/procedures. AMME addresses the upgrading of Army switching terminals. As a component of ATCAP, it focuses on the redistribution of system control from major modes to the local exchanges. AMME is targeted on new and improved message entry equipment (optical character readers, video display devices) along with software to facilitate the interface of the new hardware with local processors and AUTODIN trunks. LDDS

capitalizes on existing technology of minicomputers, microprogramming and vertical/horizontal processing to develop the advanced concentrator and automated exchange vital to the total system of the distributed network concept. This concept is another portion of ATCAP's goal of automated and decentralized military (Army and Defense Communications System) switching systems. The distributed network idea which is the core of the Local Digital Distribution System stresses increased survivability of the switching system, a less complex major switch and a strengthened control capability vested in the local switching system.[56]

In his article "The Economics of Integrated Telecommunication Systems," Arthur D. Hall III raises some important points with respect to the application of the Wired Garrison Design Concept. Before embracing the wired garrison concept in its entirety and rushing headlong to its implementation, one should consider Mr. Hall's argument. His underlying argument is to ask if the user response

to an innovation will support the costs involved in developing and installing that technology?

With regard to the wired garrison, Mr. Hall concentrates on the two-way service offered by the coaxial cable as the major technological advantage of the system. More studies are required before the wired garrison is implemented on a large scale. These studies are required to investigate the true advantages of such a coaxial cable system. Mr. Hall contends that certain aspects of the wired garrison design (voice-operated typewriters) need another decade of development. Some services offered by the wired garrison can be provided by the currently installed military switching equipment. Furthermore, some potential services are of questionable value and limited demand (the picturephone).

Mr. Hall bases much of his comment on his analysis of the document "Mission Analysis on Air Force Base Communications -- 1985" (April 1973). His concentration here is in the area of economic feasibility. He selects eight C-E services which could be the components of a type wired garrison.

For each service he provides a roughly calculated first cost per individual subscriber. These services and their corresponding costs ($) are telephone ($500), existing twelve channel CATV ($625), Federal Communications Commission Rules (Cable Television Report and Order of February 1972) CATV ($775), General Telephone and Electronics Laboratories' Special Service Network (television channel switching) option I ($913) and option II - increased terminal equipment facility ($1574), a telephone capability added to the Special Service Network ($125), Picturephone ($2000), Special Service Network Option I plus a full Picturephone system ($1950) and finally Base Communications System 4A, which adds a variety of terminal devices to the previously-listed system ($1800/capita on the military base).[57]

Inherent in the systems' costs is the direct relationship between system complexity and terminal size. The larger the terminal, the greater is the cost. In addition to terminal complexity/size/cost, the commander faces the prospect of increased

costs of software support for the services offered. Because of this and other economic unknowns, Mr. Hall calls for a more intensive study of the system methodology surrounding the wired garrison as an integrated telecommunications system.

From a systems engineering foundation Mr. Hall develops a matrix with the seven phases of a project life-cycle (program planning, project planning, system development, production, distribution, operations and retirement) considered against each of the seven steps of his morphology of systems engineering (from "A 3-D Morphology of Systems Engineering," IEEE Transactions on Systems Science and Cybernetics, April, 1969, Arthur D. Hall III). These seven logical steps of systems engineering are problem definition, value system design, systems synthesis, systems analysis, optimization of each alternative, decision-making and planning for action. Mr. Hall believes that all seven of these logical steps should be applied to each phase of the project life-cycle. This has not been accomplished with the integrated telecommunication

system. In particular user needs have not been considered across the entire life-cycle of the project.

He submits five recommendations, all of which warrant attention in this chapter. Studies of user needs should be continued with strict adherence to sound systems engineering practices. In addition to the major C-E design study, there should be concurrent efforts to determine the feasibility of implementing portions of the total design concept on an individual basis. A tentative evaluation model should be developed to best analyze the input from needs research. All possible alternative C-E designs should be studied. From this set of alternatives a group of possible designs should be isolated and evaluated. Finally, a testbed/ field laboratory should be established for more accurate feedback of user needs and greater freedom to modify the system in a dynamic, operational environment.[58]

Chapter 4. studies just such a testbed/field laboratory of the Wired Garrison Design Concept at Fort Bliss, Texas. Chapter 5. then investigates the application of a type system to the needs of Fort Leavenworth, Kansas.

ENDNOTES (Chapter 3.)

(Sources repeated from preceding chapters' ENDNOTES are given in full for easier reference by the reader.)

[37]J.G. Wohl and others, Integrated Communications-Electronics Systems and Facilities for Army Garrisons (Bedford, Mass.: The Mitre Corp., 1973) pp. 5-7.

[38]Major General Jack A. Albright, "Communications Command: First There Was a Lantern," Army, October 1975, 93.

[39]Michael J. Flax, PPBS and Future Trends in Our Society (Bedford, Mass.: The Mitre Corp., 1971) pp. vii-3.

[40]William C. Rowland, "Changing Perspectives of the Communications Industry," Signal, November/December 1975, 32-35.

[41]Flax, op. cit.., pp. 3-4.

[42]Ibid., pp. 4-5.

[43]Wohl, op. cit., pp. 21-23.

[44]Ibid., p. 23.

[45]An interview with Mr. Sid L. Bonnel, Director, Communications-Electronics, Fort Leavenworth, Kansas 66027, conducted on 7 November 1975 (updated with interviews and telephone conversations since that date).

ENDNOTES (Chapter 3., continued)

[46]Wohl, op. cit., pp. 25-26.

[47]Ibid., p. 1.

[48]Ibid., p. 27.

[49]Wired Garrison Project Team (Sponsor - United States Army Communications Command), System Definition for Army Wired Garrison C-E Design, Vol. II, "System Definition," 1974, 55.

[50]Ibid., p. 56.

[51]Wired Garrison Project Team (Sponsor - United States Army Communications Command), Vol. I, "Executive Summary," 1974, v.

[52]Ibid., pp. 10-12.

[53]Ibid., pp. 12-13.

[54]Brigadier General Gerd S. Grombacher, "The Army's View of Trends in Military Switching Systems," Signal, August 1975, p. 80.

[55]Major General Jack A. Albright, "R & D Requirements and Perspectives," Signal, October 1975, p. 66.

ENDNOTES (Chapter 5., continued)

[56]Grombacher, op. cit., pp. 79-81.

[57]Arthur D. Hall III, as cited from his "The Economics of Integrated Telecommunication Systems," 18 January 1974, by the Wired Garrison Project Team in Vol. III, "Appendices," pp. 20-26.

[58]Ibid., pp. 26-33.

Chapter 4.

The Testbed Approach

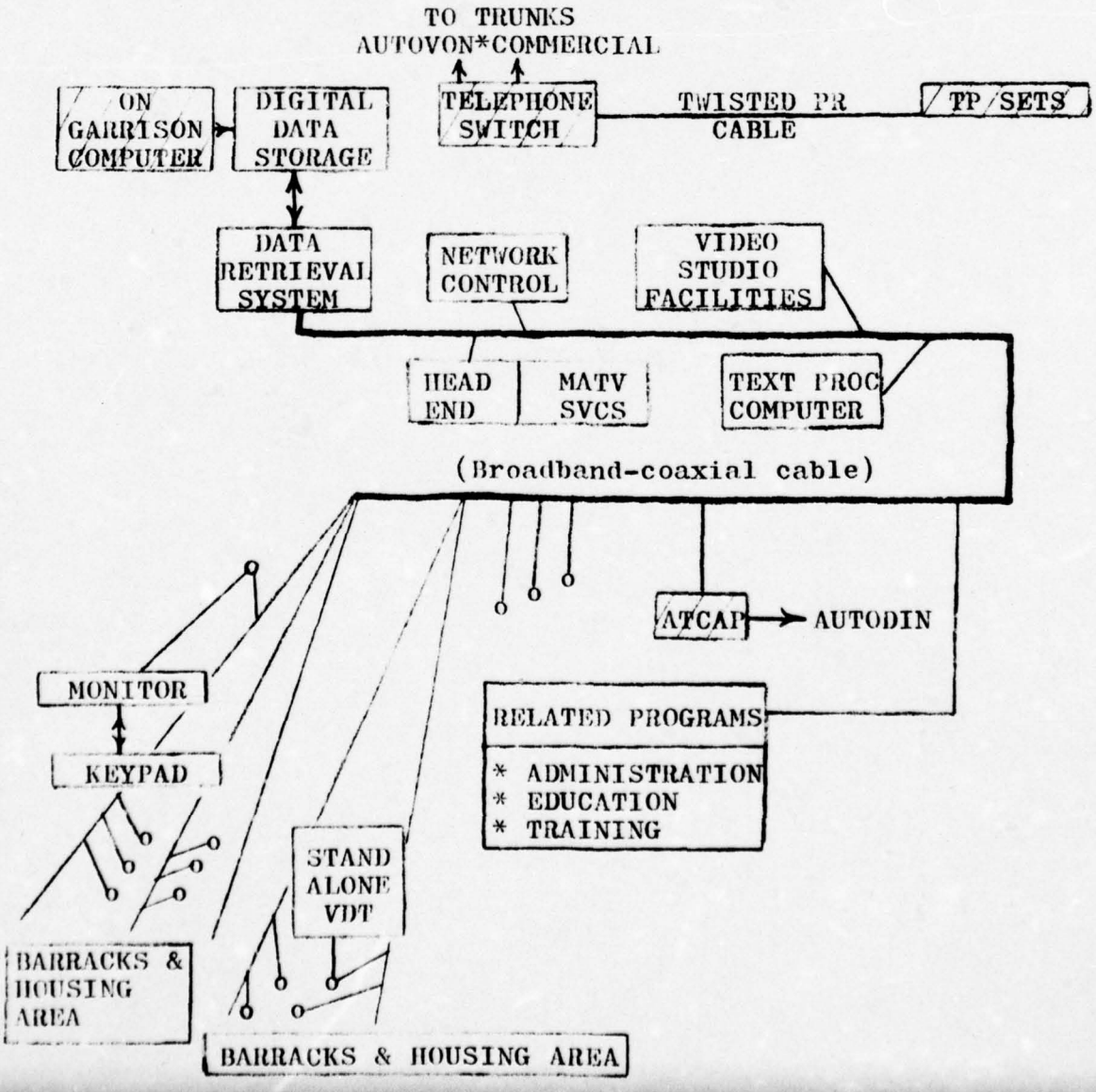
Chapter 4. discusses briefly a testbed approach to the application of the Wired Garrison Concept at Fort Bliss, Texas. A testbed is an actual representative Army installation at which a type of Wired Garrison Design can be built, operated and evaluated. The best experience factor with the Wired Garrison Design is this plan developed by the Mitre Corp. for Fort Bliss. The Mitre Corp. has found the plan to be technically and operationally feasible. The installation of the Wired Garrison Design at Fort Bliss is planned to begin upon the completion of an on-going cost-benefit-risk analysis.

The extensive study and detailed design for Fort Bliss provides an insight into a plan for Fort Leavenworth. The user need environment at Fort Leavenworth is similar in many respects to that of Fort Bliss. Therefore, the improved C-E services, increased communication system capacity and

substantial user benefits to be accrued by Fort Bliss can be translated into similar gains for Fort Leavenworth. Because this is a prototype design, an explanation of it is helpful to the reader before examining the Fort Leavenworth situation.

Diagrams of Wired Garrison Design configurations are followed by explanations of the individual system components. Included in Chapter 4. are also criteria for the evaluation of the testbed performance. The diagrams are sequentially ordered to build the Wired Garrison Design in phases. The diagram on page 57. illustrates the basic broadband transmission/distribution segment of the Wired Garrison Design. The diagram on page 62. presents a switched hub, any number of which may be connected to the broadband transmission/distribution portion shown on page 57. The diagram on page 63 incorporates the switched hub into the Wired Garrison Design to portray a complete system. Finally, the diagram on page 64. illustrates the flow of information into and out of the complete Wired Garrison Design.

The following diagram portrays the backbone transmission/distribution portion of a type of Wired Garrison C-E Design as suggested for the testbed Army installation.[59]



The system components (e.g. network control, video studio facilities) described in the Fort Bliss testbed are identical to those in the Fort Leavenworth Design in Chapter 5. The difference lies in the number and configuration of these components at Fort Bliss and Fort Leavenworth respectively.

The network control is the brain of the broadband transmission/distribution design. It establishes and manages the information exchanges within the Wired Garrison Design as well as the interfaces with the peripheral equipment (terminals). An individual minicomputer or set of minicomputers forms the center of the network control. Surrounding the minicomputer are matrices for switching (hardwired), data processors for signalling and circuit supervision, computers for control of system elements, interface modems for access to the coaxial cable and devices to monitor system status.[60]

The coaxial cable is the broadband transmission/distribution means. The dual cable plant will be laid underground and installed on utility poles. The coaxial cable plant will include repeater-amplifier units.

The existing on-garrison computers (Management Information Systems Office) will be connected to a digital data storage unit (common to the entire Wired Garrison Design with access from any point in the system). The data retrieval system which is also connected to this common data storage is a Wired Garrison innovation. This digital data retrieval system will have a minicomputer for the management of the data base and will have a 120 to 170 megabyte storage unit. This data base management will allow simultaneous user access for 50 to 75 terminals.

The telephone switch and telephone sets shown on page 57. signify the existing Army installation equipment which can be incorporated in the Wired Garrison Design.

The MATV - Headend and Video Studio Facilities include video, tape, commercial television and closed-circuit television capabilities for the installation users. The headend has tape recording and playback units. The video studio has studio-type color and black and white television cameras

which will interface with the entire Wired Garrison system through the coaxial cable.

The text processing computer consists of a minicomputer (to manage the data base access) which will locate/retrieve microfiche upon request. The storage capacity will equal 3 million pages of text (75,000 pages per carousel, 56 carousels, 4 banks with 9 tiers per bank). The minicomputer will control image conversion and routing of video data to the appropriate requesting terminal. A multiport communication processor will accompany the minicomputer for simultaneous access to the data base.[61]

The barracks and housing areas as well as on-post user locations will contain stand alone VDT (video display terminals) and keypad/monitor units. These elements enable users throughout the Army installation to have direct access to data and message information stored throughout the Wired Garrison Design. These units interface directly with the coaxial cable without the need for expensive terminal equipment. Such a location possesses the capability to store textual material, input data, receive high resolution microfiche and of course provide a video

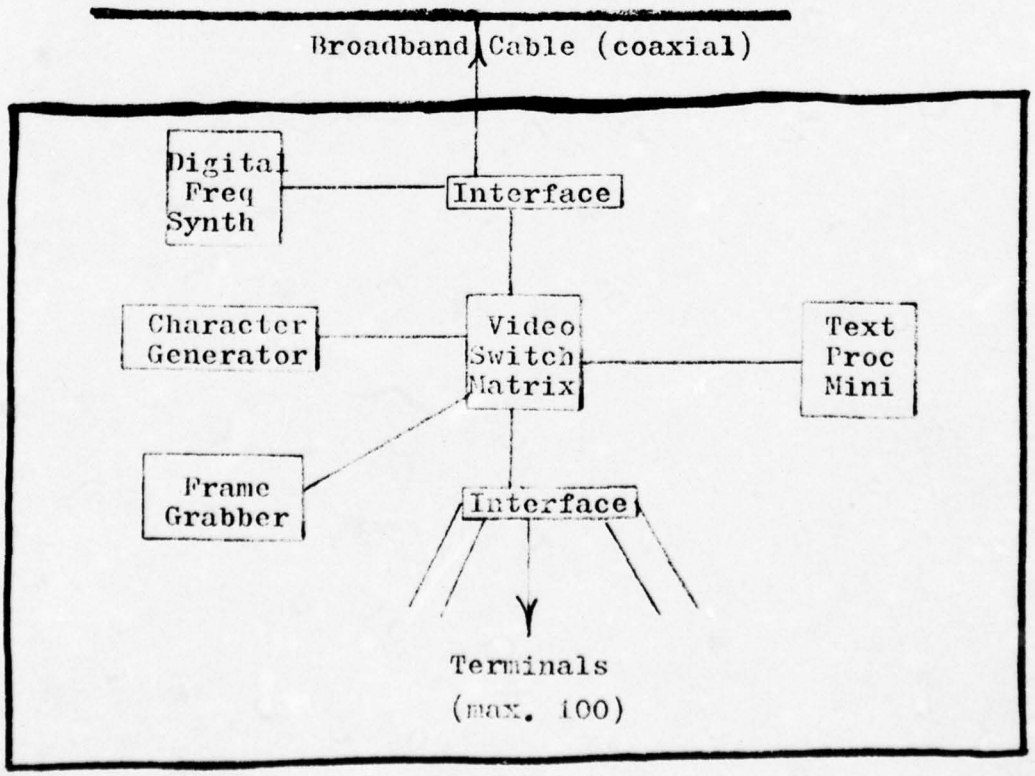
display of input and associated information.[62]

The 300 Megahertz bandwidth of the coaxial cable shown on page 57. and just discussed allows for a variety of simultaneous uses. The frequency management includes the areas of supervision and signalling, low bit rate data, high bit rate data, Federal Communications Commission standard television channels (commercial television), Federal Communication Commission standard FM channels, FDM (frequency division multiplexing) telephones and special use video.[63]

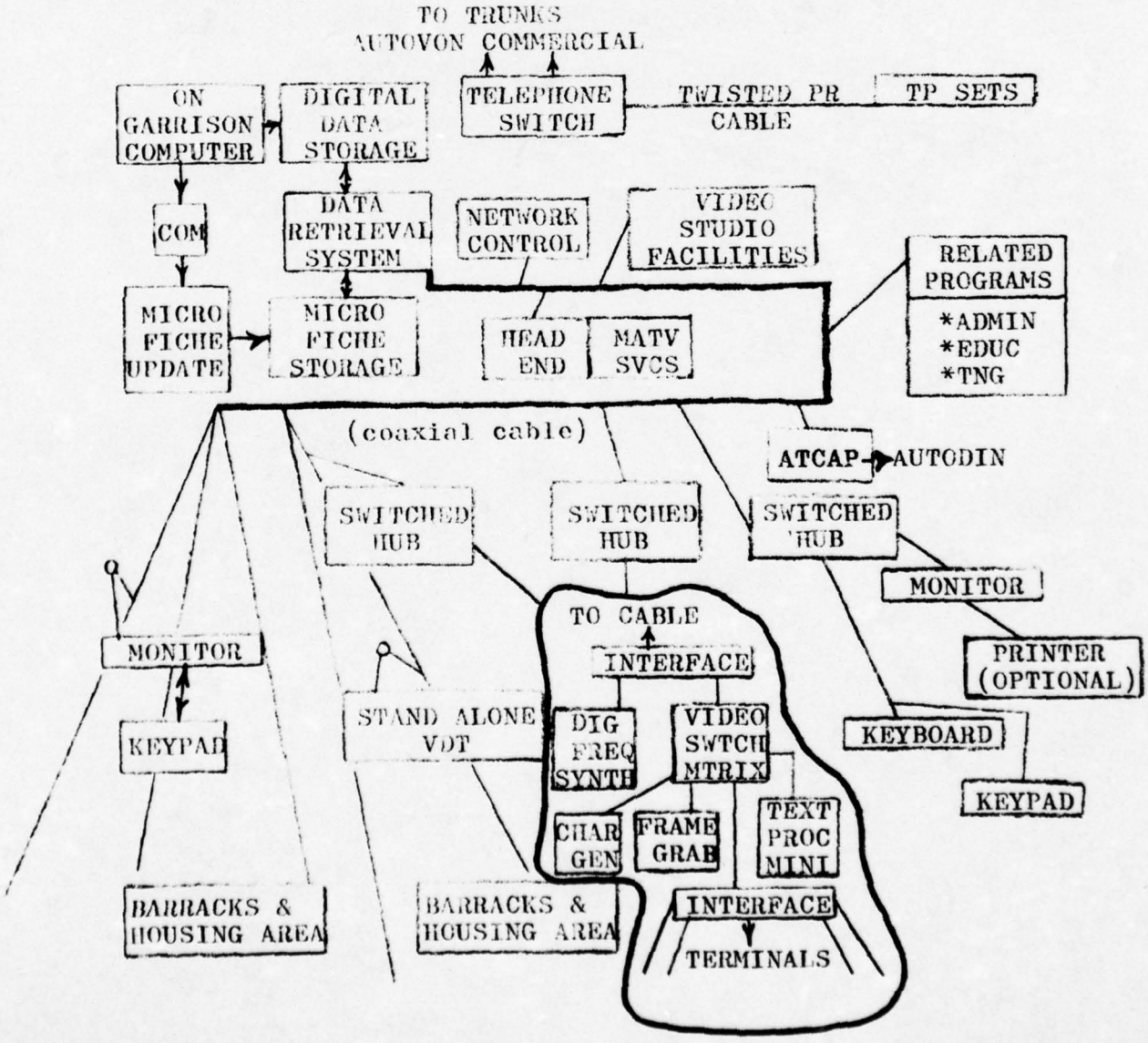
The Switched Hub as shown on page 62. can be located anywhere throughout the Wired Garrison Design as illustrated on page 63. to provide a greater range of C-E services than are available at a stand alone VDT. The typical switched hub consists of a video switch matrix (hard circuits) to allow the user terminals to access the system. The text processing minicomputer is similar to the microfiche processor contained in the central Wired Garrison Design (see page 60.) but with less capacity. The digital frequency synthesizer enables the hub to interface with the coaxial trunk and allows data communication with the central wired garrison system.

The frame grabbers and character generators are components which translate the user terminal instructions into a language common to the Wired Garrison system and acceptable to any data storage base or processor in the system. A switched hub can provide for 25 of the 100 associated terminals to access the central Wired Garrison Design at any one time.[64]

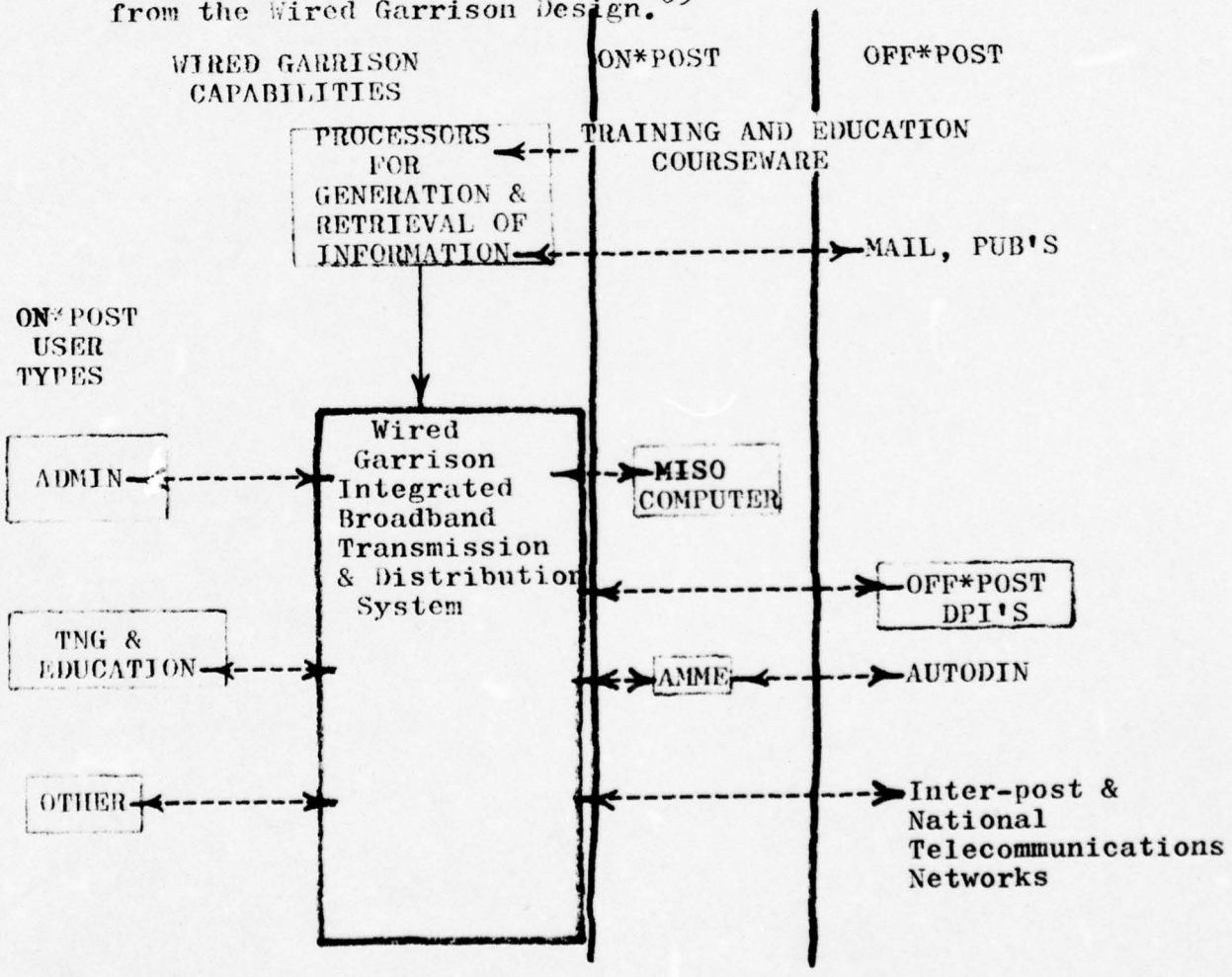
A Switched Hub



(The following diagram portrays a type of Wired Garrison C-E Design as recommended for the Fort Bliss testbed by the Mitre Corp.)



A general diagram of information-flow on a testbed Army garrison will assist in system design[64] and in understanding information flow to and from the Wired Garrison Design.[65]



In the Fort Bliss testbed certain criteria were established for system evaluation. These standards of performance are broad enough and general enough

to have applications beyond the type of Wired Garrison Design established at Fort Bliss. For that matter, these criteria may be used to design and evaluate a type wired garrison design for Fort Leavenworth, Kansas.

The standards of performance can be grouped in eight general areas. These standards are especially suitable for the testbed application of a design concept. Furthermore, they are particularly appropriate to be used in conjunction with the fourteen previously-mentioned categories of C-E services suggested for the testbed. These criteria are based upon improvement of a given job performance and acceptability of the service to the user. The general nature of performance and acceptability lends itself to the extrapolation of testbed feedback to other activities and combinations of activities.

The first of these eight criteria is the value of the new communications-electronics services provided by the wired garrison design to post operations. That is, what benefits does the testbed

application of the wired garrison bring to the Army installation?

The second area worth considering is the possibility of innovative applications of technology being added to the wired garrison. To what extent may new equipment be integrated into the C-E design of the wired garrison?

Another criterion is the characteristic of traffic flow associated with each particular C-E service. That is, what is the nature and volume of the information traffic passed by each testbed service?

The fourth area is the question of service modification. How, if at all, should the testbed C-E services be expanded or altered to better meet Army installation user needs?

Also to be considered is the extrapolation of the testbed final results. The decision-makers should review which testbed candidate services may have an application throughout the Army.

Then too, what should be the plan for implementation of the integrated communications-electronics design at

a given Army installation? This question addresses the sequence for introduction of the wired garrison design. Inherent in the sequence is the extent to which the design concept should be applied on a given Army post.

The next standard for testbed evaluation is the important area of user acceptance difficulties. How did the actual subscribers receive the candidate C-E services offered by the testbed application? In this portion of the testbed evaluation, care must be taken to isolate and examine each problem area after it is identified.

Finally, the tradeoff of performance for cost should be reviewed. This entails a value judgement as to those measures of performance which should be considered. These measures should then indicate when the improved performance warrants the additional cost where applicable in the testbed.[66]

Input to the testbed evaluation will be both subjective and objective in nature. The subjective input will consist essentially of opinions of users

as to the acceptability of the C-E services. In this regard the sample of opinions should be broad-based and adequately representative of true user need.

The objective performance evaluation can be somewhat more exact. The possible areas for quantifiable input to the evaluation process will vary with the design of the wired garrison concept at each particular Army post. Some suggested areas which lend themselves to measurement are the time for messages to be prepared for transmission, the time for the incoming message to travel from the communications center to the addressee and the number of errors contained in outgoing messages. Other areas are total time for handling intra-post messages, the time required to prepare and edit all written transmissions, the number of errors in typed material, the time needed by learners to master a given course and meet acceptable standards of performance and the manpower requirements to support installation operations. Two other quantifiable areas are the amount of space needed to store

information and the time required to retrieve needed information from a data bank.[67]

The technical performance of a testbed communications-electronics system can be evaluated by the same means used to test the effectiveness of any telecommunications system. Some possible performance criteria are the time required for network control to respond to a query from a terminal, the terminal-to-terminal transmission time for messages, the quantity of terminals capable of simultaneous operation and the degree of system reliability. Other standards of technical performance are the facility with which the operators use the system components, the readability of the visual displays, the response times of systems when functioning at peak load and the system requirements for power and environmental control (humidity and temperature).[68]

ENDNOTES (Chapter 4.)

(Sources repeated from preceding chapters' ENDNOTES are given in full for easier reference by the reader.)

[59]Wired Garrison Project Team (Sponsor - United States Army Communications Command), System Definition for Army Wired Garrison C-E Design, Vol. II, "System Definition," 1974, 146.

[60]Ibid., p. 139.

[61]Ibid., pp. 140-144.

[62]Ibid., p. 141.

[63]Ibid., p. 137.

[64]Ibid., pp. 142-143.

[65]Ibid., p. 121.

[66]Wired Garrison Project Team (Sponsor - United States Army Communications Command), System Definition for Army Wired Garrison C-E Design, Vol. I, Executive Summary," 1974, pp. 17-18.

[67]Vol. II, "System Definition," pp. 150-151.

[68]Ibid., p. 153.

Chapter 5.

The Fort Leavenworth Application

Chapter 5. investigates how the Wired Garrison Design Concept may be applied to Fort Leavenworth. In this regard a type Wired Garrison System is considered.

This chapter identifies fourteen information transfer services afforded the Army installation by the Wired Garrison. Each service is explained and related directly to advantages accrued to Fort Leavenworth through the implementation of this integrated communications-electronics design.

The chapter then discusses the development of the Wired Garrison Design for Fort Leavenworth to provide these C-E services for information transfer. After developing those factors in the Combined Arms Combat Developments Activity and the Command and General Staff College, the

paper builds the Wired Garrison with diagrams. These factors of C-E service for Fort Leavenworth are considered through the configuration of those Wired Garrison components introduced in Chapter 4. The equipment configurations shown in the Chapter 5. diagrams are tailored for the provision of C-E services most beneficial to Fort Leavenworth.

The first diagram illustrates a plan for the management of the 300 MegaHertz bandwidth of the coaxial cable at Fort Leavenworth. The next diagram presents the broadband transmission/distribution segment of the design. This is followed by a modular arrangement of the switched hubs to be used with the broadband transmission/distribution segment. The final diagram combines these switched hubs with the transmission/distribution portion to form the complete system. Additionally, cross-hatching of components indicates which elements should be installed initially.

A discussion of implementation procedure is followed by Conclusions and the Recommendation.

The Mitre Corp. team identified fourteen information transfer services available to Army garrison users through the application of the Wired Garrison Design Concept. These services and the technology which provides them are incorporated into the Fort Leavenworth design. Information transfer involves a multitude of C-E data exchange combinations involving information sources and information users.[69]

The first service is the distribution of messages on-post. This capability will reduce the time and manpower requirements for the transfer of the message from the telecommunications center to the individual addressee. Ordinarilly this function is performed by messenger service. The Wired Garrison provides for facsimile service for hard copy information transfer and video display service for rapid transmission of message content. These services can operate between the telecommunications center and individual users as well as among the individual users.

Another service is the computer-processing of textual material. The 3 million page microfiche storage capability gives expanded file capability to

the users in the Combined Arms Combat Developments Activity (CACDA) and the Command and General Staff College (CGSC). Also, post users can access information concerning evolving doctrine, utilize it for test purposes and edit/modify it where necessary.

As with the on-post message handling, the service of data distribution on the installation would eliminate the human factor. There would be no need to hand-carry the paper input and printout from the computer. The expanded number of terminals with access to the central computer would provide greater student and faculty use of the facility. Furthermore, with these computer terminals distributed throughout the installation, users would not need to queue up at just a few common locations. They could access the computer from terminals in all the classrooms and all the housing areas.[70]

There also is the important area of CAI (computer-assisted instruction). This service supported by the Wired Garrison throughout the installation will allow the individual learner to pace his or her

own instruction. Officers may prepare material for CGSC and enlisted persons may prepare themselves in their Military Occupational Specialties (MOS).

As an assist for security operations, television surveillance (video facilities in the Wired Garrison) will increase control and reduce the manpower requirements. Such a service is best suited for remote observation of isolated activities. The Military Police Desk Sergeant could monitor television sets which provide coverage of such areas as the commissary, the post exchange, the post theater and facilities of the installation club system. All of these locations are targets for theft and require constant patrolling by foot and vehicular units. Television monitoring as a part of the Wired Garrison would reduce the manpower needs. At the United States Army Disciplinary Barracks, the Wired Garrison surveillance system could reinforce existing security measures.

A service particularly applicable to the instructional/training situation of Fort Leavenworth is that of educational television. These closed circuit systems

can provide support to the user at home, at work and at education centers.

Another Fort Leavenworth service is provided by MATV (master TV antenna). Such a capability can bring to the user both commercial and program television. There is no need for individual television antennas at each set of quarters. Reception will be much better with the larger master antenna, and the coaxial cable which is bringing other C-E services to the Fort Leavenworth user can bring the television service also.

The installation command information program and for that matter, post information program covering public information can be disseminated by CITS. This is the commander's integrated television system. Instead of the numerous bulletins, letters and announcements distributed on post, periodic television programs will accomplish the same purpose with less wasted time, money, paper and labor. Furthermore, instead of an impersonal printed message, the user will appreciate a human being speaking to him or her through the means of television.

Users in isolated locations (outlying buildings in the CACDA organization) can be afforded access to the full range of centrally-stored data. Both microfilm and microfiche can be retrieved from post data banks. Once doctrine has been evolved or developed, it will be placed in the central data storage banks. Thereafter, users may access this information as necessary. This will eliminate the time-consuming searches in CACDA and CGSC for the resident experts in certain areas.[71]

Another service for Fort Leavenworth is related to the recent Privacy and Freedom of Information Acts which have affected much of the government information control. This involves the strictly controlled access by authorized persons to official information files. In the Wired Garrison Design only those persons so authorized will have the necessary information to access those data files which are denied all other users.

A C-E service which directly supports the Army installation command and staff structure is the audio and video teleconferencing facility in the

Wired Garrison Design. This capability can save time for managers and money for the taxpayers. This service eliminates the need for group meetings wherein key personnel are taken from their places work for extended periods of time to attend these meetings. Teleconferencing allows the Commanding General to converse with and see those persons in CACDA, CGSC and post operations directly involved in a particular issue. When other issues are covered, participants in the discussion can enter the conversation without leaving their offices. If additional information is required on a particular question, the manager is already in his place of business to avail himself of the necessary data and then share it with the other members of the discussion immediately through the video display facility of the Wired Garrison.

MIS (Management Information Systems) require a data management system for optimum results. The Fort Leavenworth Wired Garrison Design can provide remote access to this system for all users to avail themselves of the files generated by all installation

activities' input. The minicomputers discussed in Chapter 4. form the key to data base management in both the central system as well as in the switched hubs. Therefore, the Wired Garrison Design will enhance data base management and also make the data base available to more numerous user terminal locations.[72]

The PPBS can be supported by the Wired Garrison Design C-E service. Because of the improved management of the installation data base, increased user input of data about post operations it will be easier for the comptroller and senior managers to quickly access the information they require to monitor post operations. They can rapidly determine which agency or activity is using which resources and what will be their projected needs. Therefore, this design will help with budgeting, planning, scheduling and accounting for all post operations.

Finally, C-E services can aid in the control of the use of post support facilities. Remote control and monitoring may be applied to utilities

and security functions. Telemetry devices installed with gas and electricity connections to individual post quarters would provide immediate feedback to a central location. One person in a central facility could thereby monitor power use throughout the installation. For purposes of cost billing the utility customers, this same person could calculate cost per customer and then bill the users at home without ever leaving the confines of the central utility monitoring point. As conservation of energy becomes increasingly more critical, this same central control point could adjust gas and electric distribution on post to meet customer needs most efficiently. In addition to the above-mentioned television surveillance of secured areas, sensor devices monitorited centrally could reinforce the visual means. Thermal, sound and photosensitive sensors could detect unauthorized intrusions into secure areas and transmit that information to the central security control point.[73]

Now that the services afforded Fort Leavenworth by the Wired Garrison have been reviewed, the paper moves to the development of a C-E system to provide them.

In developing a Wired Garrison Design for Fort Leavenworth, the peculiarities of this garrison's environment should be considered against the general design presented in Chapter 4. of this paper. The focus of the Fort Leavenworth application is on Bell Hall and the adjacent buildings which support the United States Army Command and General Staff College. Bell Hall would be at the center of the post Wired Garrison Design. The integrated C-E system would branch out from this central academic building to other facilities on Fort Leavenworth and other activities of the Combined Arms Center to include the Combined Arms Combat Developments Activity. The Wired Garrison (ARBITS) Design would support the Training Development by the Combined Arms Center and provide the capability to export this development to other CONUS installations to serve both active Army and reserve component units.[74]

For the short-term (two years) period, some communication-electronics projections may be made

with a high degree of certainty. However, other C-E requirements are difficult to forecast accurately. All projections should be considered in the context of the on-going Army-wide telecommunications programs.

The short-term C-E outlook for Fort Leavenworth is related closely to the implementation of Army-wide telecommunications programs. For example, Fort Leavenworth is scheduled for a site survey/site preparation as a part of the AMME Program (Automated Multi-Media Exchange) discussed earlier in this paper. The installation also is projecting an upgrade of the systems control/technical control facility. The Combined Arms Combat Developments Activity (CACDA) and The Training and Doctrine Command (TRADOC) are evaluating the sufficiency of traffic volume to support a secure facsimile capability. Such a service at Fort Leavenworth would enhance the ability of commanders and key staff for teleconferencing.[75]

Any forecast of Fort Leavenworth communications-electronics requirements should include an appreciation of CATTS (Combined Arms Tactical Training Simulator). However, at this date the exact course and limits of CATTS on the installation and in the Army have not been established.[76] General projections visualize the CATTS interface with tactical operations centers at Fort Leavenworth as well as the export of CATTS access to active Army and Reserve Component commanders and their staffs in the field.[77]

Two installation communications-electronics areas which have been under consideration for some time are the channel-packing at the USACC - TRADOC DPFO (Data Processing Field Office) and the negotiation with the Southwestern Bell Company to assume Class B telephone service for quarters' telephones. The channel-packing option as submitted by the CODEX Corp. has been rejected. The data/communication interface is an important consideration in any plan.

As indicated by the appropriate diagrams contained in this thesis, the Wired Garrison Design visualizes a common point of technical/system control of the data and communication aspects of the operation. Assuming that Southwestern Bell does secure the contract for the unofficial telephones on the post, it would be two years before the company takes over that portion of the system and operates it. Including the Pershing Park quarters, which Southwestern Bell already serves, the company would be serving a total of approximately eighteen hundred lines. Inherent in this Bell deal would be the leasing by the federal government of cable (plant in place) to Southwestern Bell. Individual pairs would be leased back as required by the federal government. Bell would also be involved in the installation of some new cable and the phase-out of other segments of cable. Again, the projected completion of this takeover and transfer is two years hence. Therefore, any consideration of the Wired Garrison Design (ARBITS) at Fort Leavenworth should include an appreciation of this on-going transition of the Fort Leavenworth

post telephone plant.[78] Because of currently evolving policy on CATV, the Wired Garrison Design for Fort Leavenworth as it relates to television will focus on the CCTV/ETV (closed circuit television/ educational television) benefits derived from a broadband cable plant.[79]

In a related C-E area the Fort Leavenworth DPFO has experienced strong demands for increased user support. Currently the DPFO is operating with a capability to terminate 128 low speed terminals and 32 high speed terminals at approximately 80 percent of capacity. There now exists a requirement to secure a minimum of six high speed lines to the DPFO. Based upon past growth trends, the DPFO will continue its expansion over the next two years. This expansion is contingent upon the availability of funds/ hardware.[80] This is another area which would benefit from the flexible expansion characteristic of the Wired Garrison Concept.

In Bell Hall there is an ideal situation for the implementation of the Wired Garrison Design. The present piecemeal arrangement of voice, data

and video facilities could be consolidated in one or more switched hubs of a Wired Garrison Design. A type design for the Bell Hall system is included later in this chapter. Not only is the space available for equipment installation in the building, but the ducts for the cable already exist.[81] Also, the map maneuver switchboard in Bell Hall is available for incorporation in the design.

A key to the Bell Hall application is the interface of the Wired Garrison coaxial cable plant with the existing post telephone plant. This is possible as portrayed in Chapter 4. and again in the diagrams to follow in Chapter 5. Bell Hall Classroom 7 (Learning Resources Center/Media Planning Center) would be an ideal terminal location. For that matter, this same room would be an appropriate site for the initial switching hub to be installed in Bell Hall.

The services which the Wired Garrison Design could provide to Bell Hall classrooms can be classified in seven groups. Actually these same services would be available to any agency at Fort Leavenworth with a terminal to access the

system through an appropriate switching hub. These seven groups are the remote retrieval of formatted information, remote entry of data, interactive remote computer access, message distribution, reception of video-taped material and live television broadcasts, data/audio/video teleconferencing and data/video telemetry.[82]

These services are applicable not only to the academic needs of the Bell Hall classrooms. They also are well-suited to support the entire CACDA portion of the Army mission, the post operation and the people in the Army community. For example, the system is capable of retrieving microfilm, video tape, computer data, colored transparencies and printed documents from their respective libraries and banks. The data which could be entered remotely includes that from punched cards, magnetic tape, mark sense forms and keyboards in either a console or portable configuration. The computer access from any location would make it possible to update files, generate reports, conduct CAI (computer assisted

instruction), develop graphic portrayals, apply mathematical techniques to tactical/logistical problemsolving, author/execute computer programs, edit texts, utilize appropriate packages of software and interconnect with off-post TRADOC associated systems. The distribution of documents and messages can be accomplished in both the open and secure modes. The video tape and live television capability of the existing system could be incorporated into the Wired Garrison Design. The data/audio/video teleconferencing would serve the chain-of-command as well as the classroom. Finally, telemetry has applications in the fields of surveillance, measurement of systems and monitoring of on-going operations.[83]

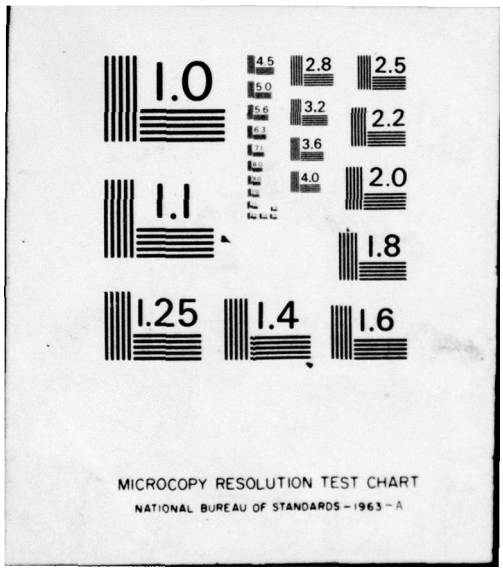
As indicated earlier, the AMME (Automated Multi-Media Exchange) portion of the ATCAP (Army Telecommunications Automation Program) is considered in the development of any Wired Garrison. Based on state-of-the-art technology, it would be most appropriate to implement AMME at Fort Leavenworth subsequent to

AD-A031 567 ARMY COMMAND AND GENERAL STAFF COLL FORT LEAVENWORTH KANS F/G 17/2
THE WIRED GARRISON DESIGN CONCEPT APPLIED TO FORT LEAVENWORTH, --ETC(U)
JUN 76 K D SAKAS

UNCLASSIFIED NL

2 OF 2
AD A031567

END
DATE FILMED
12-76

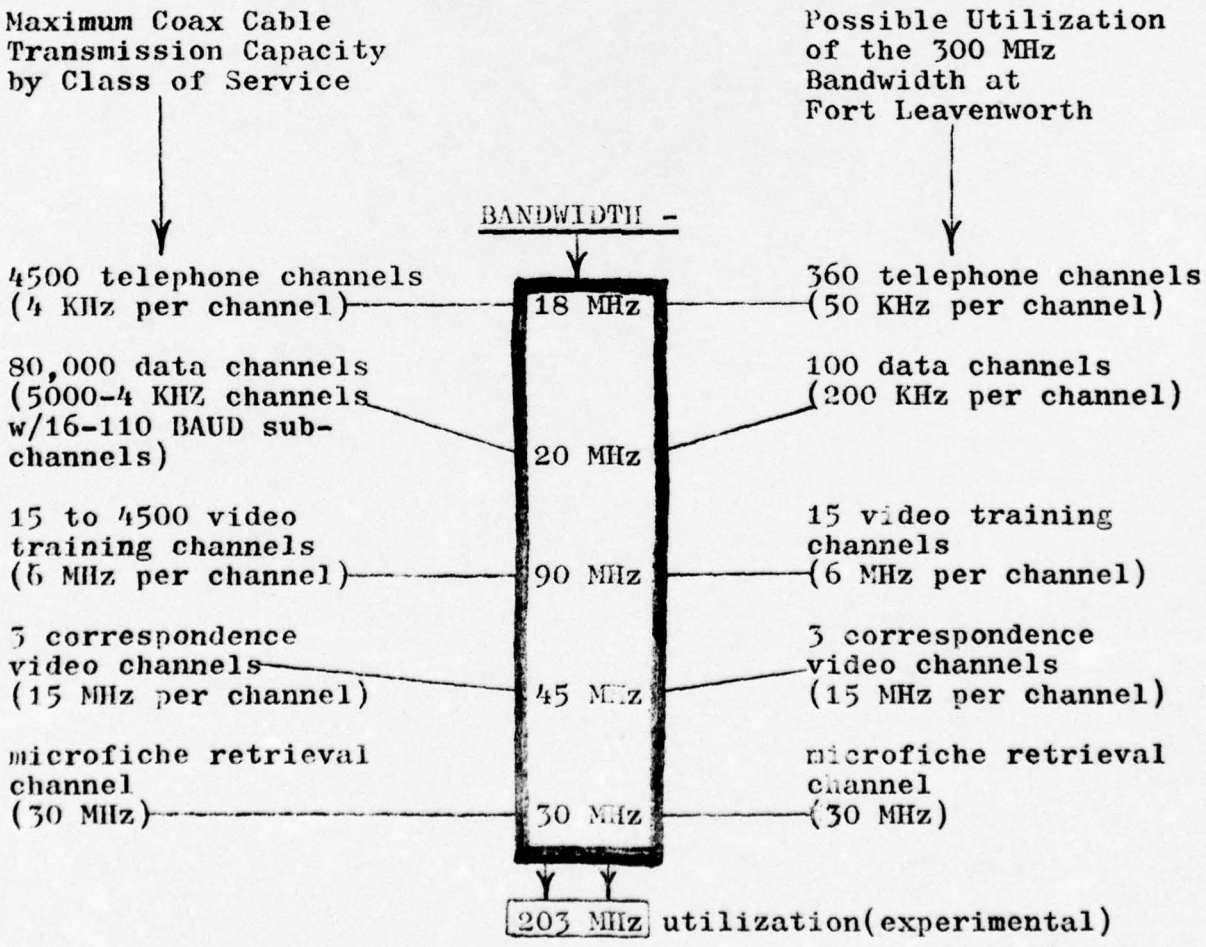

1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS - 1963 - A

the installation of the Wired Garrison Design (ARBITS). That is, the benefits of AMME would make the Wired Garrison all the more useful in support of CACDA and the Command and General Staff College. Ideally, AMME should be implemented at Fort Leavenworth concurrently with the scheduled upgrade of the installation's C-E technical control element. This would entail assigning a more urgent priority to the AMME work at Fort Leavenworth. Such an action would reduce the total amount of change and disruption to the post system. AMME will provide the post with the latest innovations in military switching. The Wired Garrison Concept would then make optimum use of the benefits afforded by the Automated Multi-Media Exchange (AMME).[84]

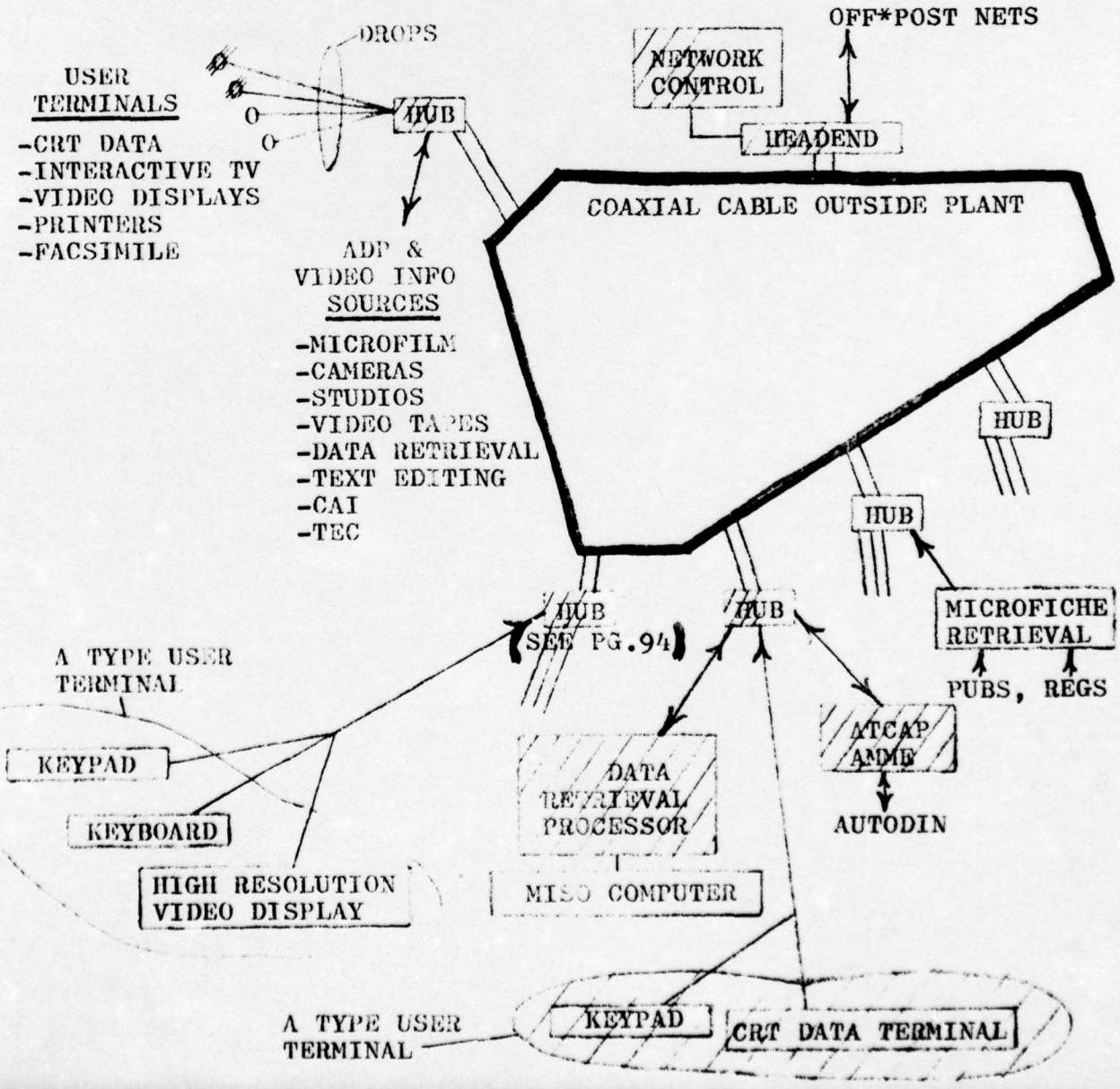
Essential to the design of a type of wired garrison system for Fort Leavenworth is a plan for the utilization of the 300 MegaHertz bandwidth inherent in the coaxial cable. Although innovations in the application of fiber optics to the broadband transmission/distribution system may affect the

eventual use of the coaxial cable, the Fort Leavenworth "Testbed" will incorporate the coax technology.[85]

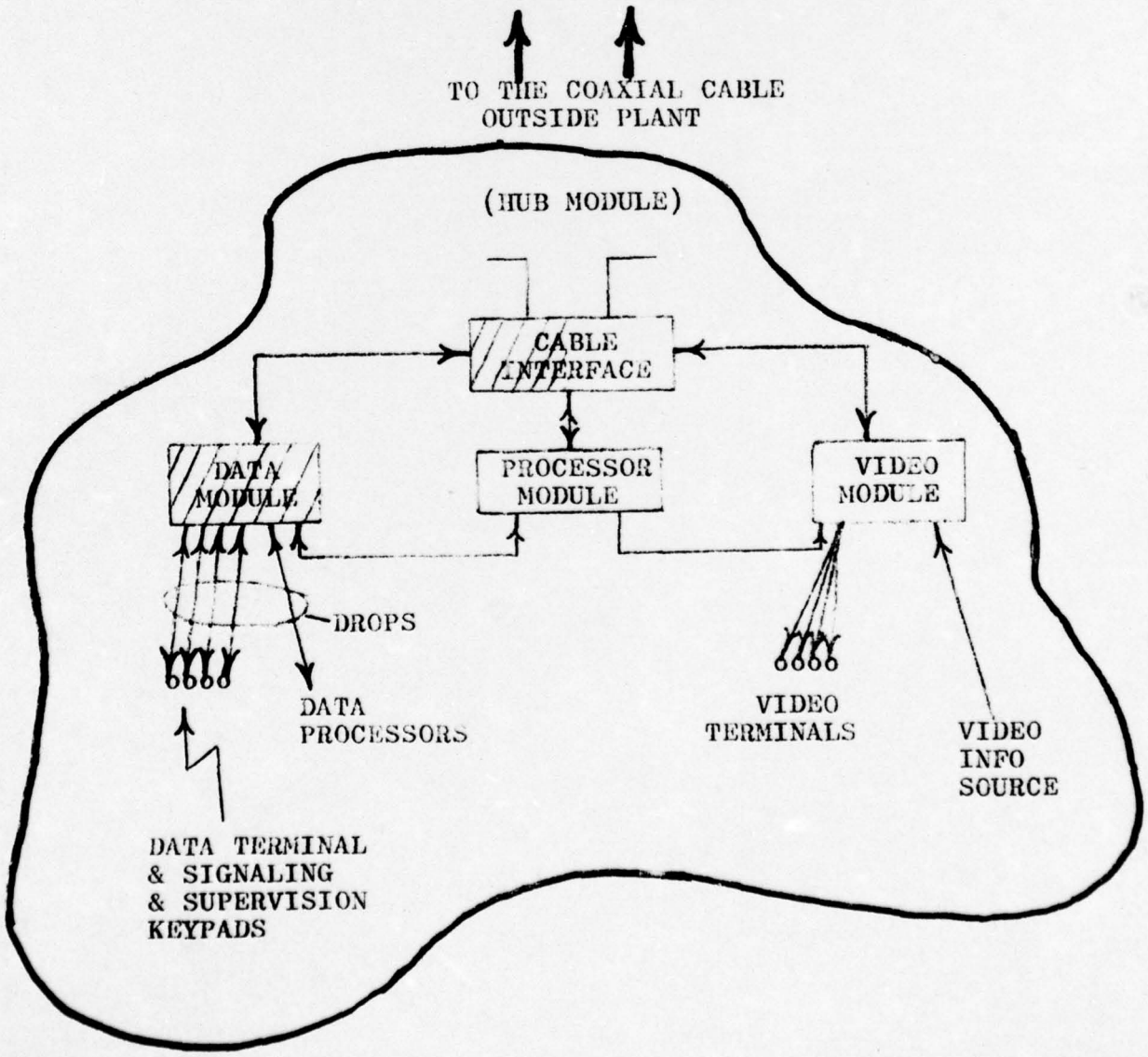
The following diagram presents a type design for the bandwidth use at Fort Leavenworth.[86]



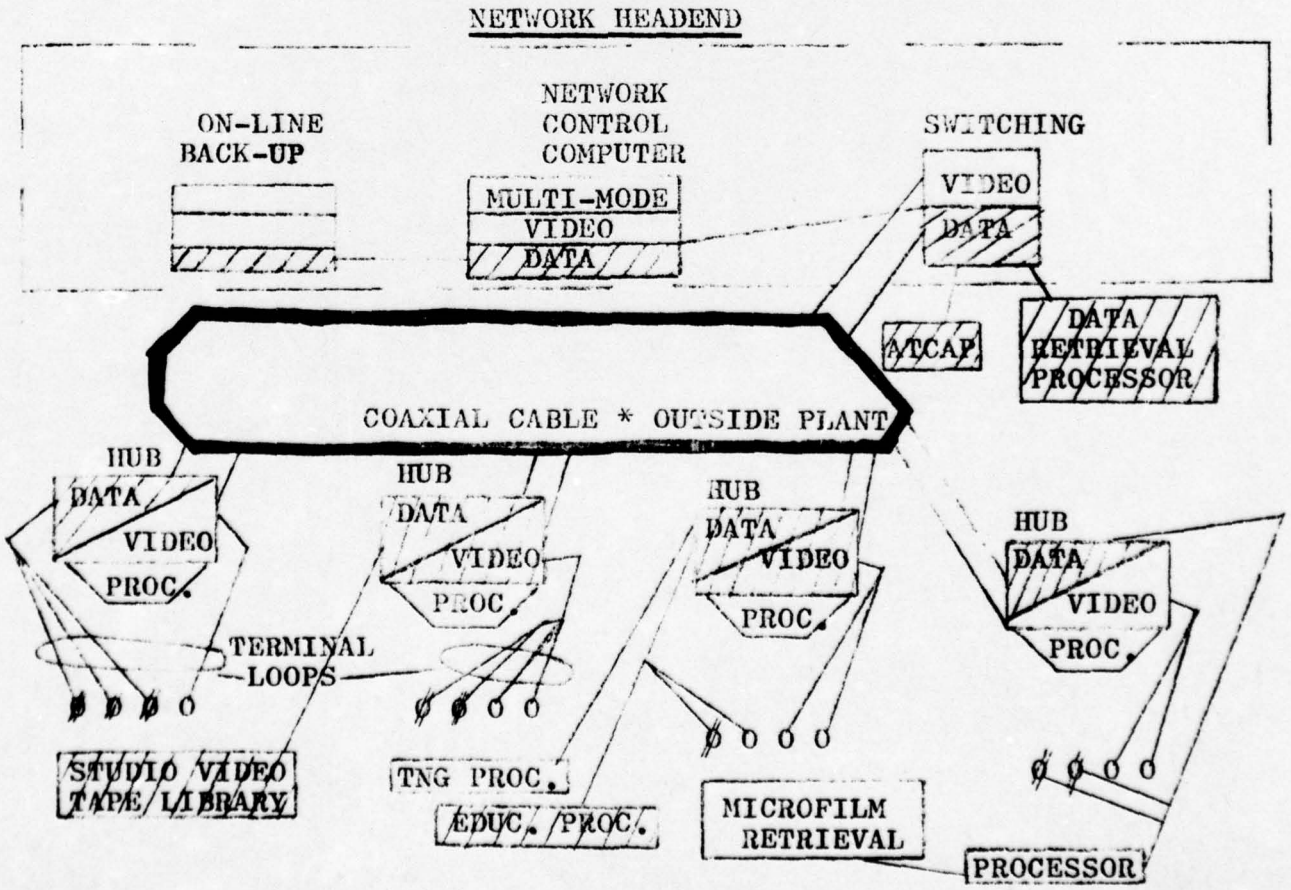
The following diagram portrays a type Wired Garrison Design to support Fort Leavenworth and to provide the [illegible] previously-described C-E services.[87]



The following diagram represents a type configuration of equipment for a switching hub in the Wired Garrison Design for Fort Leavenworth.[88]



The following diagram represents a type of arrangement of the network headend and switching hubs at Fort Leavenworth. The number and locations of the hubs and user terminals are flexible.[89] In a two-phased implementation the cross-hatched components would be installed initially followed by the remaining pieces of equipment in the second phase.[90]



The Wired Garrison Design may be implemented either in its entirety or in phased segments. The phased approach would mean that the broadband transmission/distribution segment shown on page93. would be installed initially. Upon its completion, the switched hubs of page94. can be phased-in as required. The total system (to include microfiche capability) would appear as portrayed on page95 . If the

integrated C-E design was installed in its entirety without phasing, it would, of course, appear as shown on Page 95., without any intermediate steps.

The choice of implementation plan will depend upon the Army installation where the actual application of the Wired Garrison Concept takes place. The full-scale implementation and phased implementation are submitted as two options. However, other variations of these two general approaches are possible.

On Army posts where C-E requirements are easily defined and services clearly identified, the full-scale implementation has its advantages. However, where the whole C-E environment is more dynamic and user needs cannot readily be projected, the full-scale approach lacks the flexibility to adjust to changing user environment.

The phased approach provides for an operational wired garrison system earlier in its implementation than does the full-scale approach. Furthermore, the very nature of phasing allows for the design

to be modified as the results of its evaluation are collected. Of course this very flexibility may make it necessary to redesign and rebuild portions of the system initially implemented and later found to be inadequate. Also, in that the phased implementation provides earlier system operation, this generates operating costs earlier in the implementation than does the full-scale approach. In fact these operating costs may be more accurately classified as costs for testbed operation to generate feedback on the Wired Garrison Design.[91]

CONCLUSIONS

The Wired Garrison Communications-Electronics Design Concept (ARBITS) can be applied to Fort Leavenworth, Kansas. Assuming that all of the necessary equipment is available, a type of Wired Garrison Design is appropriate to meet the communications-electronics needs of the installation. The Wired Garrison is suitable to support the United States Army Combined Arms Combat Developments Activity. This concept is particularly applicable to the needs of the United States Army Command and General Staff College.

The Wired Garrison C-E Design Concept can provide a wide variety of capabilities to Fort Leavenworth. These are remote retrieval of formatted information, remote entry of data, interactive remote computer access, message distribution, reception of video-taped material and live television broadcasts, data/audio/video telemetry. The design would incorporate existing systems where appropriate and introduce the new technology where necessary.

RECOMMENDATION

A type of Wired Garrison Design could be applied to Fort Leavenworth, Kansas. This paper describes such an appropriate system in Chapter 5.

Feasibility criteria may be grouped in three categories - technical, operational and economic. Technical feasibility addresses the availability of the equipment and systems to implement a given design. The components of the Fort Leavenworth Wired Garrison Design are in fact available for incorporation in the integrated C-E design. To be operationally feasible a design must be able to produce those user services predicted. The Wired Garrison Design can deliver these benefits.

What remains for further study is the economic feasibility of installing the Wired Garrison Design at Fort Leavenworth. Economically a design must demonstrate that it will operate at a lower cost over the long-term or short-term than the existing system would.[92]

Therefore, it is recommended that a cost-benefit-risk analysis be conducted to evaluate the economic feasibility of the Wired Garrison Design at Fort Leavenworth. Such a study should be oriented on the Combined Arms Center as the focal point of combat developments conducted at Fort Leavenworth in conjunction with other TRADOC installations.

The Wired Garrison Design should have Bell Hall as its physical and technical center. The classrooms in Bell Hall and the surrounding facilities of CACDA would be included in the Wired Garrison Design through switched hubs and terminals as illustrated in the diagrams in Chapter 5.

ENDNOTES (Chapter 5.)

(Sources repeated from preceding chapters' ENDNOTES are given in full for easier reference by the reader.)

[69]Wired Garrison Project Team (Sponsor - United States Army Communications Command), System Definition for Army Wired Garrison C-E Design, Vol. I, "Executive Summary," 1974, 16.

[70]Ibid.

[71]Ibid., pp. 16-17.

[72]Ibid., p. 17.

[73]Ibid.

[74]The Lamp, "CAC Envelops Training Program in Reorganization," December 10, 1975, 3 and 10-11.

[75]An interview with CW4 B.C. Hedge, Plans/Operations Officer, United States Army Communications Command Detachment, Fort Leavenworth, Kansas 66027, 11 March 1976.

[76]A visit to the CATTS (Combined Arms Tactical Training Simulator) facility at Rucker Hall - Fort Leavenworth, Kansas 66027.

[77]The Lamp, op. cit.

[78]CW4 Hedge, op. cit.

[79]An interview with Mr. Sid L. Bonnel, Director, Communications-Electronics, Fort Leavenworth, Kansas 66027, conducted on 5 March 1976.

[80]CW4 Hedge, op. cit.

ENDNOTES (Chapter 5., continued)

[81]An interview with Major J.B. Channon, DRI, USACGSC, Fort Leavenworth, Kansas 66027, March 1976.

[82]Assistant Chief of Staff for Force Development, United States Army Communications Command, Fort Huachuca, Arizona 85613 (With the assistance of the Mitre Corp., Bedford, Massachusetts 01730, Subsystem Project Plan (SS/PP) for the Army Wired Garrison Testbed (Fort Bliss, Texas), November 1974, 5-22.

[83]Ibid.

[84]CW4 Hedge, op. cit.

[85]Mr. George Tully, (Interview) USACC (CPS - PD), Fort Huachuca, Arizona 85613, conducted on 12 March 1976 by telephone.

[86]"Maximum Coax Cable Transmission Capacity for Each Service Class," (Diagram provided by Mr. George Tully.

[87]SS/PP, pp. 29-34.

[88]Ibid.

[89]Ibid., pp. 97-108.

[90]Ibid., p. 98.

[91]Vol. I, "Executive Summary," pp. 20-22.

[92]Jerome Kanter, Management---Oriented Management Information Systems, Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1972, pp. 79-84.

BIBLIOGRAPHY

Primary Wired Garrison Studies:

Assistant Chief of Staff for Force Development, United States Army Communications Command, Fort Huachuca, Arizona, 85613 (With the assistance of the Mitre Corp., Bedford, Massachusetts, 01730, Subsystem Project Plan (SS/PP)for the Army Wired Garrison Testbed (Fort Bliss, Texas), November 1974.
An updated appreciation of the Wired Garrison (ARBITS) in general and the Fort Bliss Testbed in particular.

Costa, L.P., and M.N. Sherman. Army Base Information Transfer System (ARBITS) Testbed Applications (Preliminary), (Working Paper), Bedford, Mass.: The Mitre Corp., 20 August 1975.
A detailed view of the application of the Wired Garrison Design Concept (ARBITS).

Wired Garrison Project Team (Sponsor - United States Army Communications Command). System Definition for Army Wired Garrison C-E Design, Vols. I-III. Bedford, Mass.: The Mitre Corp., 1974.
A comprehensive analysis of a designated Wired Garrison Testbed.

Wohl, J.G., and others. Integrated Communications-Electronics Systems and Facilities for Army Garrisons. Bedford, Mass.: The Mitre Corp., 1973.
A study of current and projected garrison communications-electronics plant. This study formed the basis for the Wired Garrison Concept.

Documents Related to the Wired Garrison Studies:

Flax, Michael J. PPBS and Future Trends in Our Society. Bedford, Mass.: The Mitre Corp., 1971.
An excellent study of problems related to the management of communications systems. Operations of the Defense Communications System (DCS) are projected into the 1980's.

Helfrich, N., and others. Planning Considerations in Technical Control for Digital Communications. Bedford, Mass.: The Mitre Corp., 1971.
An excellent study of problems related to the management of digital systems. Operations of the DCS are projected into the 1980's.

Jones, M.V. Estimating Methods and Data Sources Used in Costing Military Systems. Bedford, Mass.: The Mitre Corp., 1965.
Applicable report prepared for the United States Air Force Systems Command.

Mackey, Thomas A. Classification of Console Displays and Their Functional Applications. Bedford, Mass.: The Mitre Corp., 1969.
Peripheral material with samples of cost comparisons.

_____, and J.C. Penney. USAF Command Post Data Flow Study. Bedford, Mass.: The Mitre Corp., 1968.
Provides material concerning USAF experience in areas similar to the Wired Garrison Design.

Rich, E.S., and others. Services Information Flow and Transmission Systems in Limited War Operation. Bedford, Mass.: The Mitre Corp., 1965.
A study for the elaboration of Command and Control Requirements for all Services on a Joint Task Force.

Smith, Ralph Lee. "The Wired Nation," The Nation, May 18, 1970, (a reprint).
This article is an early discussion of the impact of cable communications on society.

Sobel, Stephen A. A Preliminary Cost/Effectiveness Comparison of Message and Circuit Switching in Military Communication Networks Servicing Record Traffic. Washington, D.C.: The Mitre Corp., 1966.
This study deals with the important area of traffic congestion and communication delays which are at the heart of the question of system feasibility.

Tully, George. "Maximum Coax Cable Transmission Capacity for Each Service Class," (diagram).
An excellent examination of the frequency management/allocation aspects of the Wired Garrison.

Witt, R.P., and others. Air Force Planning for Digital Communications. Bedford, Mass.: The Mitre Corp., 1970.
This is a valuable resource analyzing defense communications trends.

____, An Economic Comparison of Analog vs Digital - Based Common User Communications. Bedford, Mass.: The Mitre Corp., 1970.
General background of some computer-communications system interface.

Articles Reflecting Technological Innovations:

Brooks, John. "Telephone," Forbes, November 15, 1975, 87-120.
An excellent history of innovation and change in the telephone industry of the United States.

_____, "Telephone: Part II," Forbes, January 1, 1976, 208-227.
This article is the conclusion to Brooks' previously-cited piece.

Chiffy, Frank P., and Bjorn E. Bjerede. "Communications Receivers of the Future," Signal, November/December, 1975, 16-21.
A good insight into one area of technological innovation.

Codex Corp. Data Communications Network Packet.
This packet describes a possible replacement system for a portion of the data/communications interface at Fort Leavenworth.

Collins. Collins ATX-101 Audio/Video System.
This piece describes available technology for incorporation in the Wired Garrison Design.

Communications. "'Instant' Communications for Ships at Sea," Business Week, February 2, 1976, 34.
This article discusses an application of satellite communications to responsive world-wide ship-to-shore transmissions.

Executive Briefing. "The Office of the Future," Business Week, June 30, 1975, 48-57.
A valuable insight into the advances made in the field of word processing.

Harper, William, and Ed Murdock, "Electronic Writer-to-Reader System in Data (Record) Communications," Signal, July 1975, 29-33.
An expansion of future C-E needs.

ICC (MILCO) and Timeplex. Equipment for DPFO System.
This packet describes a possible replacement system for a portion of the data/communications interface at Fort Leavenworth.

Intercity Visual Conferencing Service.
This booklet describes available equipment for incorporation in a type of Wired Garrison Design.

The Lamp, "CAC Envelops Training Program in Reorganization," December 10, 1975, 3 and 10-11.
These sources describe a new user need emerging at Fort Leavenworth, Kansas.

Penisten, Glenn E. "Data Processing + Data Communications = Telecomputing," Signal, January 1976, 34-37.
This article discusses the important interface of communications and data processing.

Prins, Dougal W., and Donald W. Krejci. "Multibeam Antennas Open a New Era in Satellite Communications," Signal, November/December 1975, 6-14.
A good view of one area of technological advances.

Resnick, Bernard. "An Industry Point of View Concerning Military Switching," Signal, August 1975, 85-87.
The title is self-explanatory.

Rowland, William C. "Changing Perspectives of the Communications Industry," Signal, November/December 1975, 32-35.
An excellent overview of trends in the commercial sector of the world of C-E.

Technology. "Shedding a One-Product Image," Business Week, February 16, 1976, 91-92.
One commercial firm's experience with graphic terminals is reviewed.

Technology. "Technology Changes the Office Telephone," Business Week, January 19, 1976, 42-44.
This is a situation report on the PBX (private branch exchange) technology.

Wiley, Richard E. "International Record Communications: a plethora of difficult issues," Signal, August 1975, 16-20.
Input from the Federal Communications Commission (FCC).

Articles About Military Communications:

Albright, Major General Jack A. "C^3 for Crisis Management," Signal, August 1975, 96-99.
A world-wide view of C^3 (Command Control Communications) applications.

_____. "Communications Command: First There Was a Lantern," Army, October 1975, 87-93.
Necessary update on the role of the United States Army Communications Command (USACC).

_____. "R & D Requirements and Perspectives," Signal, October 1975, 66.
A compact discussion of the salient R & D issues being dealt with by the Army Communications Command (ACC).

Ancker-Johnson, Dr. Betsy. "Telecommunications," Signal, January 1976, 10-14.
Views of the Assistant Secretary for Science and Technology, U.S. Department of Commerce.

Beall, Donald R. "Telecommunications: The Leading Edge of Defense Effectiveness," Signal, January 1976, 16-21.
An industry view of defense communications-electronics.

Deane, General John R., Jr. "Army Research and Development in Communications and Tactical ADP," Signal, October 1975, 16-20.
Excellent overview of Army programs.

Defense Trends. "Communications Cost," Army Times, December 3, 1975, 32.
Some recent comment on communications-electronics in the 1980's.

De Vore, Charles. "Foreign Military Sales: An $11 Billion Market for the U.S.," Signal, January 1976, 38-43.
The title is self-explanatory.

Foster, Major General Hugh F., Jr. "New Developments in Command Control Communications," Signal, August 1975, 100-104.
An R & D view of Command Control Communications.

Grombacher, Brigadier General Gerd S. "The Army's View of Trends in Military Switching Systems," Signal, August 1975, 79-81.
Information on upgrading Army communications terminals.

Heilmeier, Dr. George H. "Technology Holds Key to U.S. National Security," Commanders Digest, Vol. 18, No. 18, October 30,1975.
An informative report by the Director, Defense Advanced Research Projects Agency.

Hendricks, Colonel Arthur D. "The Military Communications-Electronics Board (MCEB)," Signal, September 1975, 12-14.
Insight into high-level C-E policymaking apparatus.

Hogan, Lieutenant Colonel Jerry H. "Translating National Objectives into Specific Defense Programs -- The PPBS," Military Review, LV (1975), 35-39.
A concise discussion of the fundamentals of the Planning, Programming and Budgeting System (PPBS) of the Department of Defense.

Hoover, William R. "The Role of Computer-Communications in Military Preparedness," Signal, August 1975, 33-38.
An industry perspective of military communications.

Jacobsmeyer, Brigadier General John H. "Trends in Defense Communications System Switching," Signal, August 1975, 82-83.
Futuristic approach to Department of Defense switching developments.

Joint Chiefs of Staff, JCS Pub. 2. Unified Action Armed Forces (UNAAF). Washington, D.C., 1959.
Necessary background material on the Defense Communications System (DCS).

Paschall, Lieutenant General Lee M. "What We Get for Our DOD Telecommunications Dollar," Signal, January 1976, 6-8.
This is a current explanation of expenditures for defense communications-electronics.

Reed, Thomas C. "Command and Control and Communications RDT & E," Signal, October 1975, 6-9 & 61.
A Department of Defense perspective.

Rienzi, Major General Thomas Matthew. Vietnam Studies - Communications-Electronics 1962-1970. Washington, D.C.: Department of the Army, 1972.
An excellent organizational and operational history of an element of the Strategic Communications Command.

Rose, Joseph, and Marshall L. Cain. "Standards for Government Telecommunications Systems," Signal, January 1976, 25-27.
A discussion of the NCS (National Communications System).

Whitehead, Clay T. "Statement on Federal Information Systems," before the Subcommittee on Foreign Operations and Government Information, U.S. House of Representatives, July 31, 1973.
The Director of the Office of Telecommunications Policy discusses electronic communications.

Interviews:

Bonnel, Mr. Sid L., Director, Communications-Electronics, Fort Leavenworth, Kansas 66027. Interviews conducted throughout the research period.

Mr. Bonnel is the most knowledgeable person at Fort Leavenworth with respect to United States Army Communications Command activities.

CATTS (Combined Arms Tactical Training Simulator) facility personnel, Rucker Hall, Fort Leavenworth, Kansas. Interviews conducted in conjunction with a visit as a part of Course 9605 - "Training for Commanders," March 1976.

These people discussed the capabilities and limitations of CATTS as well as the projected telecommunications requirements.

Channon, Major J.B., DRI, USACGSC, Fort Leavenworth, Kansas. Classroom 7.

Major Channon discussed projected innovations in instructional/learning methods at the CGSC.

Cole, Mr. Robert, Director, Communications-Electronics, Fort Bliss, Texas. Telephone interview on 12 March 1976.

Mr. Cole provided current status of the Fort Bliss Testbed and the name of Mr. George Tully as the point of contact at USACC Fort Huachuca, Arizona.

Hedge, CW4 B.C., Plans/Operations Officer, United States Army Communications Command Detachment, Fort Leavenworth, Kansas. Interviews conducted throughout the research period.

Information from CW4 Hedge supplemented that from Mr. Bonnel. CW4 Hedge was a point of contact with Mr. James Bray, 7th Signal Command (previously project officer on the Wired

Garrison Concept for two years).

Tully, Mr. George R., Action Officer/Member of Wired Garrison Study Advisory Group, USACC, Fort Huachuca, Arizona (USACC, OPS - PD). Telephone interview on 12 March 1976. Printed material provided by mail.
Mr. Tully provided status information on the Fort Bliss Testbed and background data on the ARBITS (Wired Garrison Design) Program.

Other

Kanter, Jerome. Management-Oriented Management Information Systems. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1972.
A discussion of three general areas to be considered in the study of system feasibility.